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THE FORESTS OF INDIA
VOLUME III

BY THE SAME AUTHOR

THE FORESTS OF INDIA. Vols. I, II

THE DIARY OF A SPORTSMAN-
NATURALIST IN INDIA

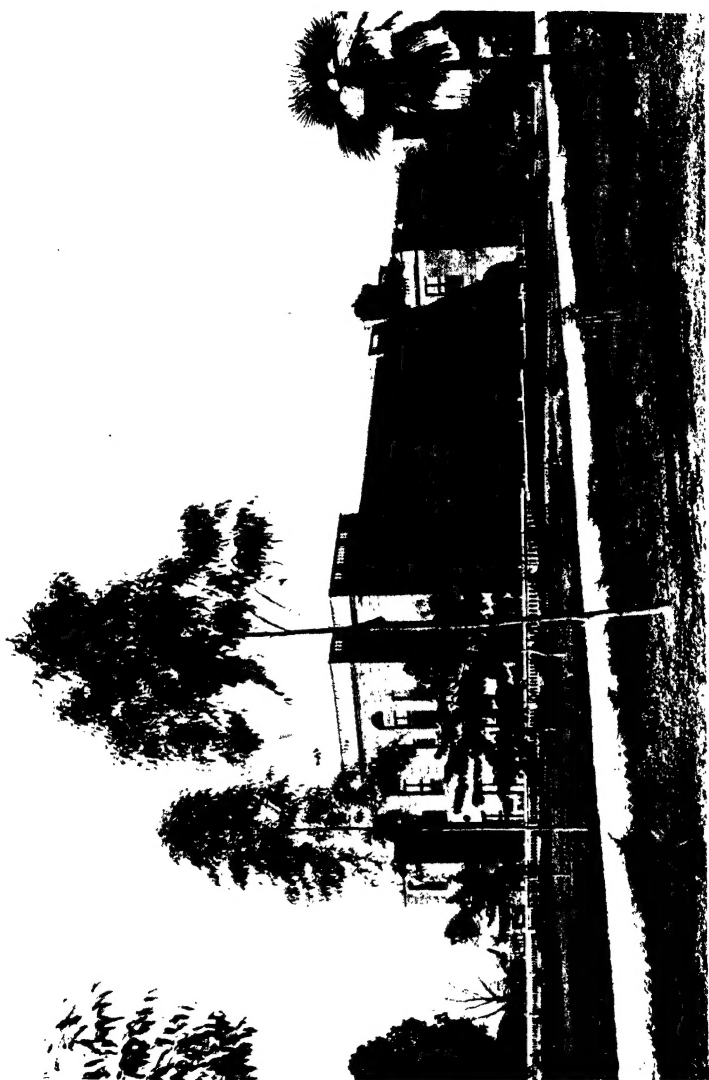
STALKS IN THE HIMALAYAS

JUNGLE BY-WAYS IN INDIA

AT THE SERBIAN FRONT IN
MACEDONIA

FROM CZAR TO BOLSHEVIK

THE BODLEY HEAD



THE FOREST RESEARCH INSTITUTE, DEHRA DUN. MAIN BUILDING AT CHANDBAGH, OPENED IN 1914

Research Institute, photo.

**THE FORESTS OF
INDIA. BY E. P. STEBBING**
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UNIVERSITY OF EDINBURGH, F.L.S.
F.R.G.S. WITH ILLUSTRATIONS FROM
PHOTOGRAPHS. IN THREE VOLUMES
VOL. III

THE PROGRESS OF CONSERVANCY AND THE
DEVELOPMENT OF RESEARCH IN FORESTRY 1901-1925

INCLUDING BRIEF REVIEWS OF THE PROGRESS
OF CONSERVANCY IN THE SEVERAL PRESIDENCIES
AND PROVINCES BETWEEN 1871-1900

JOHN LANE THE BODLEY HEAD LIMITED
LONDON

First Published in 1926

Made and printed in Great Britain at
The Mayflower Press, Plymouth. William Brendon & Son, Ltd.

CORRIGENDA.

Page 55, line 17, for 'Vol. III,' read 'Vol. II'.

Page 257, line 23, for '1920-1921', read '1921-1922'.

Page 267, line 41, for '1910', read '1901'.

Page 314, line 2, the word 'Zoology' should be inserted after 'Botany'.

Page 347, line 5, for 'April, 1901', read 'April, 1902'.

Page 387, line 10, for 'beetle-borer of teak', read 'bee-hole borer of teak'.

Page 387, line 13, for '*Hypsipyla robusta* (tom)', read '*Hypsipyla robusta* (tun)'.

Page 422, plate facing this page, for 'at Sukna', read 'at Sukna, unweeded', for 'sown in 1923', read 'sown in 1923, weeded'.

Page 425, line 42, for 'wood growth', read 'weed growth'.

Page 440, line 17, for 'cleared', read 'cleaned'.

Page 454, line 40, for 'it is carried out', read 'they are carried out'.

Page 466, line 40, for 'the Conservator', read 'the Chief Conservator'.

Page 529, line 45, for 'with rigid conditions', read 'with less rigid conditions'.

Page 600, line 28, for 'an Extra Conservator of Forests', read 'an Extra Assistant Conservator of Forests'.

Page 623, line 5, for 'the past five', read 'the past two'.

Page 637, line 11, for 'December, 1894', read 'December, 1893'.

Page 683, line 36, for 'retired, or whose circles', read 'retired, on leave, or whose circles'.

organized Forest Services in Europe. If the progress of the past few years is maintained at its high level of efficiency, and a highly trained staff will improve upon it, the value of her

forests to India as a whole, both economic and financial, will become increasingly important.

In coming back to the Forests after fifteen years' absence with, so to speak, a fresh outlook, I have perhaps occasionally regarded matters from a different viewpoint to that of the officer who has passed his service in the country. Whilst this has been a source of interest to myself, it may not prove of disservice to my colleagues in India.

In previous volumes I have drawn attention to the value of this history to officers serving in the Forestry Services under the Colonial Office. As a result of my recent tour and my study of the magnificent Research Institute at Dehra Dun, I have little hesitation in saying that a visit to certain Indian Forest Divisions with a period of study at the Institute will become, has become, a necessity for the officers of these Services if a rapid and efficient progress is desired. Once trained, and with a few years' service over their heads, India should be the goal for which the greater percentage of our Colonial Service Forest Officers should aim for a course of further training and study.

At the end of this volume I have expressed my special acknowledgments to those officers whom I met in India or who kindly prepared special memoranda for me. To Sir Peter Clutterbuck my thanks are due for the unremitting attention and kindness which he has displayed in supplying me with records, memoranda, statistics, and his great assistance in arranging my tour in India. My acknowledgments are also due to Mr. J. W. Bhore, C.I.E., C.B.E., Secretary, Education, Health and Lands Branch; Sir Clement Hindley, Chairman of the Railway Board; Mr. W. P. Sangster, C.S.I., C.I.E., Head of the Punjab Irrigation Branch; and Mr. W. F. Perree, C.I.E., late President of the Forest Research Institute, Dehra Dun.

For the many beautiful photographs I have to thank Messrs. A. Rodger, O.B.E., President of the Forest Research Institute; H. R. Blanford, O.B.E.; H. M. Glover, E. A. Smythies,

PREFACE

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J. M. Sweet, T. S. Pipe ; Major Chipp, D.S.O., M.C. ; W. E. Fluett, and others.

To Sir Sainthill Eardley Wilmot, K.C.I.E., my thanks are once again due for his kindness in reading through the proofs. Finally, our thanks (I speak in the name of the Department) are due to the Publishers for the enterprise they have displayed in undertaking the publication of a work of the somewhat technical nature of the *Forests of India*.

A glossary of Indian words and terms is appended to this volume.

E. P. STEBBING.

UNIVERSITY OF EDINBURGH,

2nd March, 1926.

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NOTE

A GENERAL review of the progress of Forest Administration in British India between 1871-1900 was given in Part II of the second volume of this history. In the present Part an attempt has been made to give for the same period, and for each province, the salient features which had a bearing upon the future progress of Forestry.

PART I

THE PROGRESS OF FOREST CONSERVANCY IN THE
SEVERAL PRESIDENCIES AND PROVINCES
BETWEEN 1871-1900

THE FORESTS OF INDIA

CHAPTER I

FOREST ADMINISTRATION IN THE MADRAS PRESIDENCY, MYSORE
(TO 1881) AND COORG, 1871-1900

IT will be remembered that in his Despatch reviewing the Forest Report of the Madras Presidency for 1869-70 the Secretary of State (the Duke of Argyll) expressed the opinion that much more might be made out of the fine forests of the Presidency ; and that of late years sound principles of conservancy had not made the progress which they should have done from the earlier start which Madras had had over the rest of India (Vol. II, p. 121). That friction existed between the Civil and Forest Officers was well known ; but it could scarcely fail to have been otherwise when the attitude of the Government and the Board of Revenue is taken into account. Matters did not improve during the next few years, as is ably shown in a clear exposition of the position, and the attitude respectively of the Government of India and the Government of the Presidency, contained in a " Memorandum on the demarcation of the Public Forests in the Madras Presidency " (15th August, 1878) by Brandis. The Governor of Madras at the time was the Duke of Buckingham and Chandos and he appears to have taken up the same *non possumus* attitude *vis-à-vis* the forestry question which he displayed towards the Government of India's recommendations during the great famine of 1876-8 (Vol. II, p. 459).

In his Memorandum Brandis, at the outset, strikes a different note—a far harsher note—than that which usually runs through his tactful Memoranda on forestry questions dealing with the Provinces, or even with the Presidency of Bombay, where matters at the period were far from presenting a roseate hue. But a perusal of this Memorandum quickly gives evidence of his reasons for assuming the attitude. With a knowledge

of the previous history of the Madras Forestry question the reader is left with a feeling of amazement and incredulity at the position herein depicted. Brandis' opening paragraph tersely explains it. "For some years past a tendency appears to have prevailed in the Madras Presidency to give up the rights of the State in the forests, or at least not sufficiently to guard and protect them. A separate forest administration was organized as long ago as 1856; but while in the provinces under the Government of India and in the Bombay Presidency great progress has been made in separating the lands which are to be permanently maintained as forest, from the great mass of forest and waste lands, no progress on an adequate scale has been made in the Madras Presidency. The consequence has been that, with the increase of cattle and population in most parts of the Presidency, denudation has made most alarming progress, and this denudation has greatly aggravated the evil effects of the late years of drought and famine."

Whilst Cleghorn was on special duty in the Punjab he and Brandis had drawn up a joint Memorandum, which they submitted to the Government of India, urging the necessity of the early demarcation of Government and village forests in the Madras Presidency (Vol. I, p. 324). This document was transmitted to the Madras Government, but its suggestions had remained without effect. In September, 1869, the Government of India addressed a communication (No. 458-F., dated 29th September, 1869) to Madras, urging the early demarcation and efficient protection of extensive Forest Reserves, chiefly in order to secure a permanent supply of fuel for the Railways. Between that date and 1878 several remonstrances had been addressed by the Central Government to Madras on this question without effect. Four instances of the existing situation were dealt with in Brandis' Memorandum. The first was the case of the Tinnevely Forests. In September, 1867, the Collector had addressed a letter to the Conservator pointing out that the river-irrigated section of the district was dependent on the continuous flow of water in the rivers rising on the Western Ghâts. This flow had notably decreased of late years, the decrease being attributed to the destruction of forests on the Ghâts, due to a great extent to the clearances of forest by coffee planters. The destruction of the fine timber forests had left the coffee gardens exposed and they were subsequently deserted. The agriculturists were now

unanimous in desiring that the remaining forests should be protected and as the Government had just sanctioned an additional anicut, at a cost of 7 lakhs of rupees, on one of the rivers it was necessary to do all that was possible to increase the water supply. He had issued certain conservancy rules and if the Conservator agreed to them was prepared to hand over charge of all the forests to the Conservator. Captain Beddome, the Deputy Conservator, had reported in detail on these areas. Cleghorn (Conservator) supported the Collector, and the Government of Madras issued orders on the subject (6th January, 1868) saying they "entirely concurred with Dr. Cleghorn that the present and perspective requirements of the southern districts ruled it eminently desirable that a skilled officer of standing should be appointed to the united range of the Madura and Tinnevely Forests" and added that "Captain Beddome's detailed report of his tour through the Tinnevely Forests indicates an immense field for forest operations." Eight years later, in a report (February, 1876) on the Tinnevely Forests, Beddome (who had succeeded Cleghorn as Conservator) remarked that Government had lately given up very large tracts of forest to certain zemindars in Tinnevely "and that this would affect certain rights and privileges of the ryots." In reply to the demand of the Government of India for a report on this matter the Madras Government stated that as the result of subsequent enquiries by the Collector, all the zemindars of Tinnevely had undoubtedly exercised some rights of ownership over the forests in their neighbourhood and had always asserted a claim to the primeval forests from times anterior to British rule. That the Madras Government, holding the opinion that the forests belonged to the zemindars, would try and obtain the lease of some of them. The Government of India (May, 1877) pointed out the discrepancy of the Government's attitude with the action taken in 1868, but to this letter no reply was vouchsafed. Beddome's report on the matter (3rd November, 1876) is interesting for the graphic description given of the coffee planters' methods. In this connection he wrote: "The planters who come over from Ceylon are now giving a very high price for land, and the whole mischief may be effected in a very short time. It must not be supposed that coffee is at all a permanent cultivation: we have only to look at the Sampajee ghât in Coorg, the Carcoor ghât and many other places in the Wynaad, the Sispara ghât on the Nilgiris, and parts of the Annamalais, to see at once that it is very often

very little better than the *Kumri* (shifting cultivation) of the hillmen. The list of deserted estates is, I fancy, much greater than that of estates kept up, and if it had not been that the price of coffee suddenly doubled itself a few years ago, there would be hardly any of the old estates kept up at all, at least in North Wynaad and Coorg; it pays a coffee planter to take up a tract of primeval moist forest on our mountain slopes for a few years; he gets bumper crops the 3rd, 4th and 5th years, but denudation of the soil goes on rapidly, and it does not pay him to keep it up many years. Can we restore the grand old forest with all its climatic influences? A thorny wilderness takes its place! "The Collector supported the Conservator's report. The Madras Government merely observed that the Government learnt with satisfaction that coffee planting was extending as mentioned by the Conservator!

The second instance was in the Cuddapah District. The Proceedings of the Madras Government for June, 1877, contained a detailed report by the Conservator on the forests of the district. The areas of forest and waste were valuable, the forest situated in four taluks was estimated at 1150 square miles, practically all the property of Government. The only conservancy as yet in existence consisted of five plantations of 1728 acres created at an outlay of Rs.41,730 and the demarcation of some small Reserves, aggregating 16,830 acres, at an expenditure of Rs.25,830; and in spite of the latter outlay these areas had been devastated by fire and grazing, their improvement under such conditions being hopeless. The Collector stated there was ample room to make large Reserves, which he suggested should be fenced with stone walls, and he endorsed the Conservator's remarks as to the devastation taking place in these forests and the ruthless destruction of young trees.

On these reports the Government of Madras observed "that with such vast areas of forest it may require further consideration whether the general conservancy of the forest area under the operation of a liberal enactment would not be more expedient and economical, whether in the interests of the State or the people, than the formation of close Reserves for fuel." Brandis wrote in the strongest terms on this matter and the Government of India addressed a letter to the Madras Government which eventually led to a scheme being sanctioned for taking up further Reserves in the district.

The third instance was the question of forming Reserves in the Coimbatore district, a large extent of hilly and thinly

populated country mostly forest and waste, but famous for the large quantities of sandal wood, *Hardwickia binata*, and black wood (*Dalbergia latifolia*), found in it. The sandal wood, it may be noted, does not grow in dense forest but on open lands, coming up in the midst of thorny bushes and so forth. The Government decided that as the royalty or monopoly in sandal wood had been deliberately abandoned in 1824 they had no rights over it and that demarcation of Reserves elsewhere should wait till a Forest Act was passed. The Government of India pointed out that the selection and demarcation of such areas as the Government might wish to create Reserves could be proceeded with without waiting for special forest legislation. But nothing was done ; and other districts in the Presidency were in much the same condition.

The fourth case, that of the South Kanara District, brought matters to a head, and may be said to have had as its ultimate outcome the placing of forest conservancy in the Southern Presidency on a proper basis. This case is discussed at great length in the report, but can only be briefly summarized here. It will be remembered that in the district of Malabar, which adjoins Kanara on the south, the whole land including the forests had been recognized as private property in the early years of the century, Sir Thomas Munro having abolished the existing Conservatorship and with it the claim to the royalty in teak and consequently the ownership of Government in the forests (save in one of two instances) in that district (cf. Vol. I, pp. 71, 84, 86). In this connection the Court of Directors, in their Despatch of February, 1840 (I, p. 86), in reviewing the chaotic position of the forestry question from 1800 onwards wrote that "the Palghat Forest in Malabar and others of considerable extent in Kanara were admitted to be the property of Government." The Government ownership of the Forests of both North and South Kanara (the North was now included in the Bombay Presidency), with the exception of parts of the forests in the southernmost taluk (Bekal of South Kanara) was never in dispute. Even Sir Thomas Munro had acknowledged (26th November, 1822) the existence of public forests in Kanara and wrote : "In order to protect the property of the public and of individuals in the forests, their limits must first be ascertained and this can only be done by a survey." Moreover, this view of the case seems to be borne out by several remarks made by the famous traveller, Buchanan, on his journey into Mysore, Kanara and

Malabar in 1801. Of the Haiga country (comprising the greater part of South Kanara) he wrote "the hills and forests belong to Government," and he said the same with reference to Honawar, the southernmost taluka of North Kanara. The suggested survey had never been undertaken up to the period in question. This brief excursion into the past is necessary since statements and orders of Munro issued in 1800, when he was Collector of the districts in question, were brought up and various interpretations given to the meanings he intended to convey by the use of the word "land," in such expressions as "all land is private property," "the only land in Kanara that can in any way come under the description of Sirkar land is unclaimed waste," and so forth. Sir William Robinson, a Member of the Board of Revenue, when the question of the ownership of the forests in South Kanara came before the Board, disagreed with the assumptions of the Collector and Conservator that the forests belonged to Government. He carried out researches back to the early days of the British Government in Madras and submitted a Minute which was dealt with by the Board in their Proceedings of March, 1871. Robinson held that when Munro used the word "land" he meant it to include all the primeval forests adjoining the cultivation existing in 1800 (although at that time the forests were regarded both by the Government and the people as valueless), and that therefore the present claims of the Wargdars (landowners) to all the forests were justified, and he sought to establish his point by declarations of succeeding Collectors, and maintained that these claims should be accepted even though in many, if not most, cases no *sanad* or other document conferring the proprietary right could be produced. The Board demurred and thought that the claims of the people would be found to be far more limited than Robinson supposed. They, however, directed the Collector to call for a register, after due enquiry, of all titles to landed property and report on them. The Orders of the Government of Madras (of which Robinson had now become a member), dated 23rd October, 1874, disagreed with the Board. They wrote: "It is abundantly evident that the attention which has been given of late years to forest-lands, and the anxiety to enforce proper conservancy, has led to a misapprehension regarding the proprietary rights of landholders or Wargdars of Kanara, similar or even exceeding that which arose between 1815 and 1822." They thought that the proposal to call for

and register all titles was wrong in principle and hard on the people and that there seemed no sufficient ground for declining to accept in its literal sense the statement of Sir Thomas Munro that "the only land in Kanara that can in any way come under the description of Sirkar land is unclaimed waste." They recommended, however, that the demarcation of valuable forests, admittedly the property of Government, should be at once taken in hand.

This work was started by the Collector, Mr. Webster, and his successor, Mr. Horsfall, and the Forest Officer, Mr. Cherry. Repeated references to the Board were, however, necessary during the course of the work, and as might be expected claims to extensive forest tracts, never previously put forward, made their appearance. In January, 1876, Beddome, the Conservator, addressed the Madras Government regarding the results of the enquiry and made the statement that, in his opinion, "the result of the enquiry and settlement, if carried out as it has been commenced, will leave Government without an acre of forest in South Kanara, either in the plains or in the Ghâts."

In April, 1876, the Collector, Mr. Horsfall, in a letter to the Board, felt constrained to ask for the decision of the Board in the case of the Parappa Forest, as it was one example of numerous similar cases which would have to be decided because Government teak plantations had been established in the areas by the Forest Department and teak had been uninterruptedly conserved since the year 1861. Kristna Puttaraya had purchased certain houses and cultivated land in 1854 from the then Wargdars and he now claimed all the forest situated round and in the neighbourhood of the arable plots including the teak plantations (for which he declined to pay the cost of formation and subsequent upkeep) and also to be exempt from any further assessment when new land was brought under cultivation. The Collector was unable to agree on the justice of the claim. He quoted Munro's statement: "the only land in Kanara that can in any way, etc.," and said it was important to determine what Munro meant by "land." Horsfall said that if Munro's statement was read in conjunction with the instructions he gave to his Assistant, dated 9th December, 1800, it would seem that Munro did not include such forest lands as were now under reference. For whilst insisting throughout on the right of private property in Kanara, Munro directed that extra rent should be charged upon such waste

land as might be brought under cultivation. Had the right of private property extended to the adjoining forest lands, Horsfall contended that Munro would not have directed the levy of rent upon any additional portion brought under cultivation. Robinson did not agree upon this interpretation and the Government of Madras curtly declined to reopen the matter and directed the Collector to proceed with the settlement.

Illustrations of this kind run throughout the history of the British administration in India, and though, as in this case, a wrong decision based on a supersensitiveness on the question of rights of property would have been to the serious detriment of the community at large, yet they furnish a direct answer to those who maintain that the rule of the British in India has had for its main object the exploitation of the country.

The Government of India was aware, from the Proceedings of the Madras Government, that the enquiry was in progress and had already displayed some anxiety upon the course the proceedings were taking. On reading the above recorded expression of the Conservator's opinion in the Proceedings they at once wrote to Madras (No. 684, dated 31st July, 1876) asking for papers explaining fully the existing position of the enquiry. These papers were received by the Government of India in September, 1876. They at once telegraphed to Madras to stay all further proceedings in regard to the South Kanara Forests and in a letter of 14th October drew attention to the grave consequences of the Madras Government's action. The reason for this drastic step was the following: Certain Wargdars in North Kanara (in the Bombay Presidency) had instituted a suit in 1870 against the Bombay Government claiming a large extent of forests whose ownership by Government had never previously been disputed. These forests were claimed, first, by virtue of certain *sanads*, alleged to have been granted by Tippoo Sultan, second, by virtue of the claimants having exercised the right of cutting trees, gathering forest produce and cultivating *Kumri*, and having paid assessment for the *Kumri* cut by them, and taxes for the collection of forest produce. The judgment of March, 1872, in the District Court was against the claimants, but they had appealed to the High Court and the case was still under decision. This being the position the Government of India felt sure (in their letter) that the Government of Madras would see the imperative reason for suspending their decision in the analogous case in

the adjoining district, though their enquiry might be proceeded with ; “ but until the decision of the High Court of Bombay has been made known it is desirable that no irrevocable step should be taken by the Madras Government as regards any of its forest rights.”

In December, 1876, Webster, who had returned to Kanara as Collector, addressed the Board, pointing out that as a result of the Government order of 23rd October, 1874, extensive *Kumri* (shifting cultivation) clearings were being carried on in the taluks of Kassergode (Behal) and Upperangadi, and large quantities of sandal wood were reported to have been cut out from jungles which, before the passing of the order, were understood and treated as Government Forests. He asked whether the Government of India's telegram directing the suspension of the order of 1874 was to be taken as requiring the prosecution of parties for cutting *Kumri* or felling timber without the 100 yards *Kumaki* limit. He added : “ I trust not, and think that if a claim of proprietary right is set up a prosecution should not be instituted.” The reply (3rd February, 1877) of the Madras Government was : “ His Grace the Governor in Council is of opinion that *Kumri* cultivation should not be interfered with.” A word of explanation is necessary as to the term “ *Kumaki*.” *Kumaki* land was analogous to what was termed “ *Rab* ” land in the Konkan in the Bombay Presidency and was used for grazing, but chiefly to provide branch loppings and leaves (forest litter) which were spread over the paddy fields (rice) and burnt to serve as manure. This form of cultivation will be described in greater detail under the Bombay Forests, in the following chapter. The extent of the *Kumaki* lands was doubtful ; but it had generally been supposed that the rights of user of the Wargdars for this purpose extended over a belt of forest 100 yards wide, adjoining the arable land.

During the early months of 1877 the Government of India received the whole of the papers with reference to the Kanara enquiry from the Madras Government accompanied by urgent requests that they should be allowed to pass definite orders in the matter. In spite of the fact that this matter of the settlement of Government and private rights to the land had been left undecided for a period of over seventy years, although for the past fifteen the Government of India had repeatedly urged that such settlement should be taken in hand, the Madras Government now contended “ that the rights of the State are being fully and satisfactorily asserted and that no good can

result from leaving matters in an inchoate and undetermined condition." In preferring their request the Madras Government submitted a long report by Mr. Comyn, now Collector (March, 1877), detailing the position arrived at. Some 1329 "jungles" had been dealt with; private claims had been admitted in 625, 23 were declared Village Reserves and 255 decided to belong to Government. No areas were given in any case, and no proper survey maps existed for the region.

In January, 1878, the Conservator reported that "South Kanara is at present in an unsettled state, as far as attempts towards conservancy are concerned, and it is not known what area of forest we shall eventually have charge of." As Cherry was going on furlough he proposed that no Senior Officer should be sent to replace him but that a Sub-Assistant Conservator should be placed in charge—a rather questionable action! Whichever way the decision was to go, in the interest of the community one would have been strongly inclined to send the best officer in the Presidency to the district. The Madras Government decided, however, that they did not think it necessary to depute any Forest Officer to the district in the existing condition of forest matters.

In reviewing the position, with all the papers before him, Brandis pointed out that the enquiry now being held in South Kanara would affect the proprietary right of Government in an area of at least 1000 square miles. That it was being undertaken in the absence of any suitable detailed survey maps, which did not exist. A survey was necessary, but this would not be sufficient. The investigation must be carried out in a much more thorough and searching manner than had yet been attempted. So far, the Conservator of Forests had been excluded from the enquiry altogether. The Collector had never referred to him, and the remarks made by the latter on the case had simply been based on information acquired privately. The Conservator should be consulted. Further, the enquiry should not be held by the Collector alone. It should be undertaken by a Special Commission partly comprised of officers who were independent of the Local Government. The orders of the Madras Government governing the enquiry were based on a one-sided interpretation of reports written seventy-eight years ago. It would be the object of the Special Commission to make a complete and searching examination into the whole history of the British Administration of the district with reference to the exercise by Government and the people

of rights in the forest. The Inspector-General pointed out that the proprietary rights in the forests claimed by the Wargdars were probably analogous to those of the people in the forests in many other parts of India, and consequently were no more than rights of user for certain defined purposes. In the petitions received from the ryots in South Kanara the Collector had stated that the petitioners only claimed permission to use the forests in the immemorial way for the collection of fuel, leaves, etc., and grazing, which would seem to show that they only enjoyed an easement and were not asking for anything more now. It was the powerful Wargdars or landowners who were now claiming extensive forests. As Brandis said: "If arguments of this nature were sound there would be few forests in India which Government could claim as State Forests, and most of the State Forests in Germany and France would be regarded as private property. In England, if such arguments were to be the guide, the Commoners, and not the Lord of the Manor, would be the proprietors of the commons on which they dug turf, pasture their cattle and collect wood, grass and fruits." The information before the Government of India appeared clearly to indicate that even before Kanara became British territory the ruling power had asserted its right and the British Government had done the same ever since the commencement of the century.

The Board of Revenue had departed from the attitude which it had first held, and was now taking the view of the Madras Government in the question; the Board had expressed the hope that when the Wargdars were placed in absolute possession of their forests "they may in their own interests put some check on *Kumri* clearings." A pious hope of this kind had been expressed by Sir Thomas Munro in 1822 in the case of the Malabar Teak Forests, but it was not fulfilled. The Board of Revenue might well have studied the history of the forests of the Presidency from that date before committing themselves to the reiteration of such a fallacy. As Brandis pointed out, nowhere in India had such proved the outcome of placing the landowners or the people in full and unchecked possession of tracts of forest to which their proprietorship had been admitted.

The settlement of the Forest rights in South Kanara should be the first work of the Special Commission, but this work, Brandis advised, should be extended and they should be entrusted with the enquiry into the State ownership of the forests in other districts of the Presidency. In the meantime,

however, the Madras Government should take measures to effect the speedy demarcation of the public forests. The Inspector-General did not omit to draw a lesson from the late devastating famine and one of the causes of the deplorable conditions it gave rise to. "In the districts the demarcation, protection and improvement of the public forests is a measure of pressing necessity, which must be no longer deferred. The misery of the late famine has been greatly increased by the denudation of the country, which has diminished the production of cattle fodder and has had an injurious effect on the water supply in streams and tanks (ponds)."

In a statement from Madras before the Government of India the total area of the Madras Government Forests was given as 9905 square miles. This applied to 12 districts only out of the 21 (Anantapur had been recently made into a separate district). This figure was a general estimate and would probably prove smaller when the area was correctly surveyed. It was recognized that the Madras Government were not opposed to the demarcation of the Government Forests, but no comprehensive statement of their policy was in the hands of the Government of India, whilst some of the expressions made use of, as, for instance, that in connection with the Cuddapah Forests quoted above, appeared to show that the Local Government did not contemplate the adoption of the necessary measures for the adequate protection of their forests.

The area of forest plantations amounted to 15,985 acres, the receipts from which were Rs.1,28,822 whilst the charges were Rs.4,74,303, including Rs.80,000 for the purchase of land. The most extensive of these plantations were in South Arcot, area 3550 acres, and the famous Nilambur Teak Plantations, area 3492 acres. The estimated area of the Fuel Reserves was 134,315 acres, of which 16,830 acres were in Cuddapah, 65,410 in South Arcot, 12,160 in Coimbatore and 19,369 in Salem. These were chiefly in the vicinity of the railways. The receipts and charges were Rs.9,609 and Rs.1,46,931 respectively, Rs.45,000 being on account of the purchase of land. This was a good commencement, but, Brandis considered, on a very small scale and out of all proportion to the requirements of the country.

The Madras Government had proposed to prepare a draft Forest Bill, but so far no copy had been submitted to the Government of India, though the latter had pointed out its great importance (No. 1381 F., of 15th October, 1877, and Reminder of 5th June, 1878). The former Government

appeared to be still rooted in the belief that it was impossible to distinguish between the rights of the Government and the people in the forests of the Presidency. It will be remembered that they had forwarded a suggested Act for the Province which was vetoed by the Government of India and that they had refused to have the new Forest Act (VII of 1878) applied to the Province (*vide* Vol. II, p. 472), and lengthy minutes explaining their reasons were written (February, 1878) by the Governor (the Duke of Buckingham), Sir W. Robinson and Mr. Huddleston, Members of Council. These minutes put the view held at the time by the Madras Government on the forestry question in so unequivocal a light as to confirm the impression that they were completely out of sympathy with the ideas and intentions of the Government of India and the Secretary of State. An interesting point in Robinson's Minute seemed to infer the existence of village or communal forests in Madras. He wrote: "No legislation can be suitable to Southern India which does not *in limine* recognise in specific terms the ancient landmarks of village communal property, and secure to the community the income of their joint property and special interest in its administration." Brandis' comment was: "If such *communal* forests really exist in Madras there will be no difficulty in organizing the administration for the benefit of the community having rights in them. Well-managed Communal Forests are a source of wealth in many countries of Europe."

The last Report in connection with the Forests of India, written by Brandis whilst Inspector-General, was entitled "Suggestions regarding Forest Administration in the Madras Presidency," issued on January 10th, 1883. This is a large volume covering every aspect of the suggested future administration of the forests of the Southern Presidency. A change in policy, with a change in the Government, had taken place in Madras and they had suggested to the Government of India that Brandis should be allowed to visit the Presidency to confer with the Government on the whole subject of forest conservancy. Brandis was placed on special duty preparatory to retiring from the Service and deputed to Madras, where he arrived on 3rd November, 1881. In apologizing for the length of his report, he states that as it is submitted on the eve of his retirement he would not have an opportunity thereafter of explaining any proposals, in case of doubt, and hence it had been necessary to use a wealth of detail which would have

otherwise, perhaps, proved unnecessary. He quaintly adds : "Such reports are not intended to be easy reading, and the greater portion of the present Report is only intended to be read by the Forest Officer employed in the districts to which my remarks relate." But in this statement Brandis was too modest. His Report might well be described as the Charter of the Madras Forests. It is a mine of useful and interesting information, suggestions and advice, based on a quarter of a century of as wide an experience of varying forest conditions and methods taken for their improvement as no man before him, and perhaps no man since, had ever enjoyed. To summarize such a Report is a task of considerable difficulty, and even the best of summaries cannot reproduce a tithe of the information nor portray the grasp of detail and the breadth of view the author so unmistakably exhibits in its pages.

Brandis spent a year in the Madras Presidency, and the following is a brief résumé of his movements and work. He arrived in Madras early in November, and with the Government's permission started on the 28th to visit the forests in certain districts, arriving at Ootacamund on the 21st March, 1882. During his tour he marched through the Chingleput and Nellore Districts in order to study the management of Jungle Conservancy under Collectors; examined a portion of the Cuddapah Forests; marched through a large portion of Bellary and the new district of Anantapur; then proceeded to Salem, South Arcot and Tinnevely; and after seeing something of Madura completed the tour in the Coimbatore District. From March to November he was at Ootacamund, and during that period, as opportunity offered, he visited the forests on the plateau and the slopes. His main work here was in connection with the Forest Bill and Reports. On April 3rd he submitted to the Madras Government a rough draft Forest Bill with a memorandum in which he sketched the outlines of the general policy which he considered should be followed in forest matters. In the preparation of the Bill Brandis had the assistance of Mr. A. J. Stuart, subsequently Collector of North Arcot, and two Forest Officers, Messrs. A. W. Peet and H. L. Wooldridge, of Coimbatore and South Arcot respectively. A Committee was appointed by the Government (Order 5 of 24th March) to prepare the Forest Bill and to consider the proposals prepared by Brandis with reference to the management of the forests. This Committee consisted of Brandis, Major Campbell Walker, now the Conservator, and the following

officers: Hon. P. O'Sullivan, Advocate-General; Messrs. E. F. Webster, Secretary to Government, Revenue Department; W. S. Whiteside, Collector of North Arcot; W. Logan, Collector of Malabar, and H. E. Stokes, Collector of Salem. Mr. A. W. B. Higgens, Head Assistant Collector, Cuddapah, was appointed Secretary. The Committee assembled on May 1st, and on 10th June submitted the draft of a Bill with a comprehensive Report on forest legislation in the Presidency which Brandis attaches as Appendix I to his own Report, the Committee's draft Bill being given as Appendix II. Both are of uncommon interest.

On May 15th the Government directed that the three Collectors on the Forest Bill Committee should, in communication with the Conservator and Brandis, consider the rules by which the relations of Civil and Forest Officers should in future be regulated and on that subject, as well as on matters relating to the organization of forest business connected therewith, a Joint Report was submitted to Government on 9th June (given in Appendix III, Brandis' Report). On September 9th Brandis submitted proposals for the reorganization of establishments, with a financial forecast which he incorporated in his Report, which will be briefly glanced at later. The Forest Bill was introduced into the Legislative Council on the 29th June, and after being altered in what Brandis terms "several essential points" by the Select Committee, was passed on 26th August, and received the assent of the Governor-General in October. A Special Act (XXI of 1882), confirming its provisions (*vide* Vol. II, p. 472), was also passed in the Council of the Governor-General and received the assent of the Governor-General on the 2nd November, 1882.

The amazing energy and driving power possessed by Brandis were well known to all who had ever met or worked with him; but they could never have been exhibited in a more remarkable manner than in the settlement thus put through in a year (even if we allow that the time was ripe for such a settlement) of difficulties which had been increasing through a period of eighty years.

It is of interest to mention that after the Committee had finished its work Higgens was left with Brandis for a time to assist him with his reports and then posted to the charge of the Forests of the Cuddapah District. Higgens was succeeded by Mr. H. A. Sim, Head Assistant Collector, Kurnool, who helped Brandis in passing his Report through the press. Sim

was then posted to the charge of the Kurnool Forests. This was a wise move on the part of Brandis, as it not only added two officers to the weak Madras Forest Staff but ensured that two Civilians in the Presidency, when they achieved higher rank, should have a personal knowledge of Forest Department work. But the additions to the staff did not stop here. The Government of Madras, Brandis writes, "have justly insisted upon the organization of a strong staff of superior officers and no reasonable expense has been spared to attain this object." Three experienced officers were transferred to Madras from the Central Provinces, in which Province great progress had been made in demarcation and settlement on the lines the Inspector-General advocated for Madras. One of these was appointed Conservator in 1883 on the division of the Presidency into the Northern and Southern Circles; four professionally trained junior Assistant Conservators had joined and the old officers of the Forest Staff had received advancement by the introduction of the new scale. It was with no unnatural pride that Brandis wrote: "I have been permitted to see the new organization actually established and I leave the Presidency in the firm hope that the Madras Forest Officers will in future take a high place for professional skill and efficiency, and that they will accomplish a work of the utmost importance for the well-being of the people in South India." And events were to show that this confidence was not misplaced.

But meanwhile the Department and the Collectors were faced with a gigantic task. Brandis discusses the work in Part I of his Report under the sections: General remarks on land areas, etc.; fuel for railways; charcoal for iron-smelting; the indirect influence of forests; and the organization of forest business. In Part II a section is devoted to the forests of each district he visited. It will be impossible to follow the author through the wealth of detail to be found in this part. But in some of the recommendations and reflections to be found here Brandis was looking far ahead, and for this reason alone this portion of his work would seem to be worth perusal by present-day Forest Officers. The first part contains the Inspector-General's main proposals.

After discussing the direct and indirect advantages of forests to a country like Madras Brandis pointed out as the direct advantages of forest conservancy that it was of the greatest importance to produce on the smallest area the largest quantity possible of timber, wood, and other forest produce, and it was necessary to determine

the yearly quantity which, under good management, could be produced permanently on a given area. In some of the forest plantations in the Presidency the annual timber production per acre was exceptionally large. Instances were the Nilambur Teak Plantations, the Eucalyptus on the Nilgiris, the Casuarina on the coast, and the plantations of *Acacia arabica* and *Inga dulcis* in tank beds and on low ground along rivers. He thought also that the production per acre of the pods of divi-divi (*Casalpinia coriaria*) might under favourable conditions prove very large. In any event he maintained that it was very important to ascertain the rate of timber production per acre on the lines which Beddome had already commenced at Nilambur (Report of 1878) and Mr. D. E. Hutchins in the Nilgiri Plantations. These remarks on plantations are a preface to Brandis' consideration of the better utilization of the waste lands of the Presidency, for he held that the chief task of the forest administration was to increase the productivity of the waste and forest lands in the interest of the community. The total area of forest and waste lands at the disposal of the Government in Madras amounted to about 32,000,000 acres. A considerable extent of this area was still claimed by zemindars and other landholders in Tinnevely, South Arcot, and other districts. These disputes were of long standing and they required early final settlement. Still the area available was enormous, and Brandis pertinently asks, What was its ultimate destination? He replies: A portion will be constituted reserved forest under the Act; extensive areas will remain grazing grounds; a large area would be available for the extension of agriculture, and this area would become the larger with the improvement of the forests and the grazing grounds. For example, in the drier parts of the Presidency the devastation of the forests had made the extension of agriculture impossible. But with strict forest conservancy in these areas the forests would improve in the course of time and with their improvement the soil conditions would also improve. Extensive tracts would have to be demarcated at the present day as Reserves. But in the future, when the soil within these areas improved, it would be possible to select areas within the Reserves for cultivation and form forest villages on these sites—in other words, extend cultivation. Brandis gave as examples the Siwalik Forest area, then forming part of the Dehra Dun School Forests in the N.W. Provinces, and areas to the east, where the policy had been laid down that forest villages would eventually be established with the improvement of the forests. Model farms, with the object of improving the system of agriculture, might be settled in this way. In answer to arguments, he said that such a policy was too bold a one for the present time as forest conservancy was new both to the Forest Officer and the people of the country, and both must first learn how to efficiently protect the forest and have an equal interest

in its protection before the forest village could be safely introduced. In connection with the question of the existence of Forest Villages in Madras the orders of the Madras Government (17th September, 1875), conveying instructions to a Committee appointed to draft a Forest Bill (which never matured), stated that an Act was required which should deal separately with forests under the head of State Forests, Communal Forests and Proprietary Forests. This was based on the statement of the Board of Revenue (Proc., August 5th, 1871): "There is scarcely a forest in the whole Presidency of Madras which is not within the limits of some village, and there is not one in which, so far as the Board can ascertain, the State asserted any rights of property until very recently. All of them, without exception, are subject to tribal or communal rights which have existed from time immemorial, and which are as difficult to define and value as they are necessary to the rural population. . . . Here the forests are, and always have been, common property." These views were endorsed by the Government of Madras in a letter to the Government of India (23rd December, 1876). This opinion was no longer held. In their Report (para. 4) of 10th June, 1882, the Brandis Committee on the Forest Bill stated their deliberate opinion that there were no Communal Forests in the Presidency. On the subject of the allotment or setting apart of free grazing grounds for the use of the ryots which was being made under the Settlement going on in some districts, Brandis suggested that this step should be deferred until the selection of the Reserves had been commenced. The two questions of forests and pasture should be considered together or the selection of the Reserves might be made more difficult by the previous allotment of free grazing in any locality.

As has been shown in previous parts under the existing forest organization the greater part of the Government forests in the hills, and a portion of those in the plains, though undemarcated, were in charge of Forest Officers and subject to one set of rules; while some of the hill forests and the greater portion of the forests in the plains were in charge of the officers of the Jungle Conservancy Fund and subject to a second set of rules. Thus all the forests in the Nellore, Chinglepart, Bellary and Anantapur Districts were under the latter, whilst in Cuddapah, South Arcot and Madura were under the one or the other. In North Arcot, South Arcot and Trichinopoly the Forest Officer was in charge of both classes of forests, which were often contiguous, but each class was managed under different rules. There was nothing in the character of the two classes of lands to call for different rules and separate establishments. It was contended that the Jungle Conservancy lands were managed for the benefit of the villages, while the forests were managed for the benefit of Imperial Revenues. But this latter, during the last ten years to 1881-2, had been insignificant, the total

surplus for the ten years having amounted to only Rs.3,29,144 ! And even this total revenue took no account of charges for furlough allowances, pensions, etc. Brandis said quite frankly that for many years to come forest administration in Madras would require a heavy outlay and that it would be exceedingly difficult to produce sufficient revenue to cover the outlay that would have to be incurred, and that any surplus revenue could not be expected. Moreover, the villagers had not derived any special benefit from the management of the Jungle Conservancy lands ; they had grazed their cattle on them and collected firewood ; they had done the same on other waste lands as well as in most of the forests. There was no difference between the two classes of forests save in name and on paper. If the Jungle Conservancy Forests were to be of real benefit they must be managed by Forest Officers under the same legal protection as was to apply to the Reserved Forests. The Forest Committee had therefore urged that the administration of the two classes of forest should be amalgamated, and this had been sanctioned by Government. The receipts and charges of the Jungle Conservancy had formerly been local. The entire Forests and Jungle Conservancy revenue would henceforth be provincial. In this manner one of the most thorny problems connected with Madras forest conservancy was at length settled.

Apart from the revenue shown as derived from " Forests " and " Jungle Conservancy," there were other items of revenue obtained partly from forests and partly from other waste lands which were credited to " Land Revenue Miscellaneous," such as the tax on trees on unassessed lands, grazing tax on grass cut, rent on palmyra trees, fruit trees, etc., amounting annually to roughly Rs.3,00,000 and about Rs.2,00,000 from the cultivation of unoccupied waste and sale of waste and the trees on it ; lastly, a considerable portion of the excise revenue was derived from the unoccupied waste ; for rent received from the use of toddy-bearing trees and arrack-renters. The total revenue so derived in 1877-8 amounted to Rs.59,50,000, a portion of which represented produce from waste lands—about 10 lakhs. This gave a total of Rs.15,00,000 collected by these two departments. Brandis suggested that it would not be unreasonable to transfer items aggregating Rs.1,00,000 from " Land Revenue Miscellaneous " to " Forests." If this were done, assuming that out of the 32,000,000 of waste lands 10,000,000 were required for extension of agriculture, 11,000,000 for pasture, whilst 11,000,000 were supposed to be under forest conservancy, the allocation of the above sum would produce an annual income of 0.8 annas per acre for the protection and improvement of 22,000,000 acres of forests and grazing grounds.

Brandis then deals at length with the question of the Improvement of the Forests. It is unnecessary to follow him here since the lines of the advice he tenders are now well known, but his opening

statement—that as regards the improvement of the forests it was immaterial whether the total area was 11,000,000 acres or more or less—is worthy of mention ; since in his treatment of this matter he distinctly stated that Madras had a long uphill fight before them, that it would take years before even the suggested Reserves were demarcated, efficiently protected, and the growing stock improved, and that at the time it was impossible to say whether this area would suffice or not for the future requirements of a growing community. As regards the forests, to commence with he suggested the Bolampatti Forests in Coimbatore (to protect the water-supply of the Noyil River), the Reserves proposed to be formed on the Nilgiri Plateau, and areas in the Bellary District (for the production of fuel, charcoal for iron smelting and cattle fodder). The total area of what Brandis terms the “so-called” reserves in the Presidency on 1st January, 1882, was estimated at 756,568 acres. Much of this area had never been demarcated nor the rights enquired into. Brandis was therefore doubtful how much of the area could be declared reserved forest under section 25 of the new Act. The Settlement Officers should make careful enquiry into each case. It is of interest to compare this statement of the position with the rather grandiose list of first and second class forests published in Beddome’s *Manual of Forest Operations* (*vide* Vol. II, p. 91). On the subject of Government lands which would not be included in the reserved forests Brandis considered that some protection should be given to them to prevent injudicious alienation and clauses with reference to the formation of “reserved lands” and “reserved trees” were inserted into the Bill, but were excluded by the Government of India. Since from these lands it might be necessary to form additional Reserves in the future, Brandis suggested certain methods by which areas regarded as suitable might be placed safe from unconsidered alienation. As regards the question of reserved trees, he suggested that a few species, teak, sandal wood and red sanders would be sufficient for the present and that the large and varying numbers reserved in different districts (*vide* Cleghorn, Vol. I, p. 317) should be discontinued as vexatious and unnecessary. In any district where another species was valuable, such as, e.g. *yepi* (*Hardwickia binata*), in Bellary and Anantapur, it could be declared reserved. Rules should also be made under the Act to regulate or prohibit *Kumri* and the cutting and removal of forest produce, regulate sales, free grants of produce, etc. As regards grazing, Brandis’ suggestions followed the usual lines of development and regulation in other forests of India.

In his treatment of the revenue and extraction work of timber and firewood Brandis considers the whole question in detail. In a previous chapter (Vol. II, Chap. III) it has been shown that the question of the fuel supply and the formation of plantations were

the chief questions at issue during 1864-70. Unequal treatment of the fuel charges was to be found throughout the Presidency, and the charges to the railway for fuel had fluctuated, whilst, with the admirable object of encouraging the growth of new industrial undertakings, fuel had been either granted them free or at low rates—the natural consequence being that all adjacent areas were quickly cut out, inflicting grave hardship on the local population, whilst the industries themselves were threatened, at least with heavier transport charges for this requirement. Of course, in this matter the advent of the railways was, as Brandis puts it, “a novel and unprecedented event.” The difficulty lay in the fact that it was still impossible to forecast their probable future requirements. Whilst the Southern Indian Railway took only small amounts of fuel, and might possibly be able to use coal alone in future, the Madras Railway, with an extending length of line, was requiring larger amounts of fuel. But in this case it could not be forecasted whether it would be cheaper for them in the future to use coal. As long as private forests existed sufficiently near to provide the requirements matters were easier, but these were being cut out with appalling celerity. It would be advisable to encourage the railway authorities to buy, so far as possible, from private forests, to give time for the efficient organization of the Government forests which would thereafter have to bear the brunt of the supply unless private proprietors could be induced to plant for this purpose.

The fuel requirements of large towns were still, in many cases, difficult of supply. The Casuarina Plantations on the east coast had proved a wonderful asset. But here again the cupidity of the merchant had made its appearance. It will be remembered that in order to encourage planting Government gave out the land on free leases. The practice had come about to take a lease, plant a crop, clear fell it within a few years, and then desert the area. Brandis pointed out that in forestry a crop usually took many years to mature, and this being the case a free lease of an area for planting purposes might be justified. But in the case of the very short rotation required for Casuarina, and in view of the growing practice of the grantees, in future a rent should be charged for all land taken up for the purpose on the east coast. At Ootacamund and elsewhere in the Presidency, advantage had not been taken of the Government's offer owing to the longer period the crops took to mature.

It is impossible to follow Brandis into his consideration of the iron ore industry in its effects on the forests. The industry was an important one in the Presidency, as is shown by the following statement which contains the crux of the matter: “One of the main objects of forestry in this Presidency must be the production of charcoal for iron smelting, and this can only be

effected by the formation and strict protection of reserved forests in the vicinity of those localities where iron is still made or where the conditions for making it are favourable. . . . The officers charged with the selection of the areas to be constituted reserved forests must pay attention to this matter, and an officer of the Geological Survey or a metallurgist with practical knowledge of iron-making should be associated with the Forest Officers in selecting the Reserves proposed to be formed for this purpose."

The section Brandis devotes to the consideration of the " Indirect Influence of Forests " is admirable, and is as valuable to-day as it was at the time it was written. In many parts of a country like India the value of the forest in its effect on water supplies is indisputable and had been recognized, as is exemplified by the following paragraph from the Report of the Indian Famine Commission (1880 : *vide* Vol. II, p. 459), quoted by Brandis : "As to the protection of the high hill slopes from denudation, it may be confidently stated that they will in any case be more useful if kept clothed with wood than subjected to the wasteful and destructive process by which they are brought under partial and temporary cultivation, and that, whether the expectation of an improved water-supply as a consequence of such protection is fully realized or not, there is, on other grounds, sufficient reason for arranging for the conservation of such tracts when it is practicable." Brandis suggested that a competent and experienced Engineer Officer should be attached temporarily to the Madras Forest Department to study the question of the influence of forests on the increase or maintenance of water in the rivers and streams.

The Inspector-General's proposals for the reorganization of the Forest Staff were elaborate, but were long overdue in the Southern Presidency. He suggested the appointment of a second Conservator and the division of the Presidency into the two following Circles :

Northern Circle :—1. Ganjan.* 2. Vizagapatan.* 3. Godavari.* 4. Kistna. 5. Kurnool. 6. Nellore. 7. Bellary. 8. Anantapur. 9. Cuddapah. 10. South Kanara. 11. Malabar. 12. Nilgiris.

Southern Circle :—13. Chingleput. 14. North Arcot. 15. South Arcot. 16. Salem. 17. Trichinopoly. 18. Tanjore. 19. Coimbatore. 20. Madura. 21. Tinnevely.

Twenty-two Deputy and Assistant Conservators would be required in the Controlling Staff, and the salaries were increased to average those in the Provinces under the Government of India. Two Forest Settlement Officers would be required of the rank of Sub-Collector and their salaries would be charged to the " Forests." The existing staff of Forest Officers numbered fifteen. The permanent additions would be three officers from the Central Provinces, four recruits from England ; the temporary ones, two civilians appointed as Forest Officers, one Engineer Officer : total, twenty-five officers.

* To form eventually a separate charge.

Six extra Sub-assistant Conservators would be required. As regards the subordinate staff, the details were greatly complicated by the inclusion of the Jungle Conservancy Forests with the Forests. Brandis' forecast of receipts and expenditure for the ensuing five years for the amalgamated forests under the Department was: Receipts, Rs.9,00,000. Expenditure—Conservancy and works, Rs.3,83,000; Establishments, permanent, Rs.4,76,000; Forest Settlement Officers, temporary, Rs.41,000: total, Rs.9,00,000, Brandis, however, thought that with expensive demarcation work in full swing the expenses would probably be heavier than his forecast—but he had his remedy. The Jungle Conservancy Fund being a local one, the surplus was carried forward from year to year. There was an outstanding balance in this fund of Rs.3,70,000. He suggested that this balance should be used to defray some of the capital expenditure of the work which had now to be undertaken by the Forest Department.

At this distance of time the other matters discussed with reference to the duties of the staff, organization of forest business, and so forth, need not be entered into.

Consideration of space render it impossible to deal with the progress made up to the end of the century on the lines recommended above. Unquestionably the forestry position and atmosphere changed in the South and the Department worked hard to recover the time and position lost. The results achieved will be dealt with in a subsequent part. If revenue is, however, any criterion to sanity in forest management the following figures speak for themselves:

Year.		Revenue. Rs.	Expenditure. Rs.	Surplus. Rs.
1883-4	. .	9,53,704	7,86,733	1,66,971
1889-90	. .	15,57,627	11,61,237	3,96,390
1899-1900	. .	23,02,290	16,53,530	6,48,760

At the close of the century the total area of forests under the Department amounted to 19,649 square miles, of which 15,862 square miles were Reserved forest and 3787 square miles of what were known in Madras as "Reserved Lands"; in all 13.9 per cent of the Presidency.

Of this area 2536 square miles only were under sanctioned Working Plans or plans were under preparation.

MYSORE

The distribution of the forests in Mysore has been described in earlier parts of this history. The Forest Rules came into

force in February, 1869. One of the most valuable timbers in the State was the sandal wood, which was a Government monopoly, and the annual revenue realized in 1870-1 was about Rs.1,60,000. In this year the Chief Commissioner of Mysore proposed to the Government of India, in order to stop the waste of timber taking place, that as all the forests of the country were public property they should be placed under the charge of Forest Officers, a number of depots being established throughout the country, where wood would be sold to all-comers. Extensive plantations were also to be formed. The Mysore Railway was to run from Bangalore to Mysore. "Its sleepers (of teak and blackwood) will be provided from the local forests of Ashtagram and Nandidrup Divisions. Teak for carriage building will come chiefly from Nagar" (*Rev. of For. Adminstr. by Inspector-General, 1870-1*).

The "district" system of forests was sanctioned on 12th March, 1872. Its main object was to abolish the system of licences and introduce a system of proper selection and felling of trees. The new departure was much opposed, but Van Someren, the Conservator, appears to have exercised tact and to have taken pains to explain to the people the objects of the new departure. All forests were placed under the Department and divided into "circles of supply," each in charge of a Forest Officer and with one or more depots. The revenue in Mysore in 1873-4 was just short of 5 lakhs of rupees and the expenditure Rs.1,12,460.

From the Government of India's remarks on the administration of the forests in 1876 progress appears to have been slow. Only 449 square miles of State Forest existed and the "District" forests in some parts of the country would not be able to continuously supply the wants of the people. Many of the forest areas were so small that their management could never be profitable. True protection was in its infancy and the Government of India suggested that Van Someren should visit the Central Provinces and study their methods.

The value of sandal wood sold in 1878-9 in Mysore was Rs.3,65,188 out of a total revenue for the year of Rs.4,52,575. This wood was a wonderful asset but an equal danger as it in fact delayed real forest progress to some extent. In 1879-80 sandal wood produced Rs.4,34,712 out of a total revenue of Rs.5,43,312.

Subsequent to this year the Mysore Forest Department was

no longer under the Government of India, the State being restored to the Maharaja.

COORG

In 1865 the forests of Coorg formed a Range under an Assistant Conservator who was subordinate to the Conservator in Mysore (Van Someren). It was known as the Forest Conservancy Department. The forests consisted of three main types—(1) sandal wood and small jungle in the north ; (2) fine deciduous forest of teak, rosewood, etc., in the east and south-east ; (3) large evergreen forests on the Ghâts along the west. Up to about 1871, except for a little planting, the main operations of the Department consisted of departmental felling and extraction of timber chiefly in South Coorg, the material being carted to Hunsur, where it was annually sold by auction. The fellings were of the usual type of the period, the finest accessible trees being selected. Fellings were also undertaken by timber merchants who could obtain licences to fell in any Government forest. West Coast merchants felled in the Ghât forests in this way. Timber required for house-building could be obtained free. These methods were doubtless in force in the time of the Rajas of Coorg. Reservation was first commenced in the eastern forests in 1870. Demarcation and survey work was carried out, and by 1875-6 an area of 308 square miles of reserved forest had been surveyed and the demarcation of all the deciduous forests of the province had been completed. Owing to realinement of boundaries the area was reduced to 295 square miles in 1877-8. The following year the demarcation of the Ghât forests commenced. In 1886-7 these forests, area 309 square miles, were declared Protected forests. The next year an area of 308 square miles of Paisaris (lands outside Reserves not included in revenue-paying or revenue free lands), Urudves (village forests) and Devarakadu (sacred groves) lands were handed over to the Department. Thus by 1888 an area of 859 square miles was under the Department. The Paisaris lands were subsequently re-transferred to the Revenue Department. In 1890-1 the Government proposed the formation of the protected forests in the Ghâts into Reserves. Settlement work was commenced the following year, but the proposal had not been given effect to at the close of the century.

In 1871 Forest Rules were introduced and the issue of licences ceased, the Department opening a number of small timber depots. These were closed in 1876. In 1878 a commencement was made to localize the felling areas. This effort

was persisted in, though, in the absence of efficient communications, the provision of which proceeded but slowly, it was found difficult to exploit valuable areas bearing teak, *honne* (*Petrocarpus marsupium*), *biti* (*Dalbergia latifolia*) and *matti* (*Terminalia tomentosa*). In 1879-80 the sole right to exploit timber in the Kerti and Urti Forests in the Ghâts was granted to a Mr. Tod, who paid a fixed sum per tree subject to a minimum of Rs.3,500 per annum. Mr. Tod soon gave up the contract and in 1896-7 the licence system was reverted to, an attempt being made to locate the fellings. This was not successful and the end of the century witnessed the unrestricted fellings in full swing once more—a deplorably retrograde step. But want of communications was the main obstacle to progress. The introduction of fire protection proved difficult. The southern portion of the Anckad Reserve was first attempted in 1876-7. From this year to 1901 the methods employed were to cut both external and internal lines and to burn them when dry, fire-patrols being also appointed. Fires more or less severe occurred annually until in 1896-7, all the areas burnt in the previous year were closed to shooting in the fire season and the subordinates in whose areas fires had occurred were severely punished. This action met with a considerable measure of success.

The first artificial regeneration work undertaken was the teak plantation in Karmad formed between 1868 and 1876. Between 1872 and 1884 ten other teak plantations were formed. In 1890 the policy was changed and the teak "*taungya*" method was introduced. The Kurubars practised shifting cultivation (*Kumri*) in the forests and were persuaded to sow teak seed with their crops of *ragi* and hill paddy (rice). The sowing was done in the hot weather. The area was again burnt and cultivated during the following year and casualties amongst the teak replaced. The Kurubars tended the plants until the close of the second hot weather, when they were paid at the rate of Rs.1.4.0 per every 100 surviving plants. This method proved very successful. Planting of teak in the Ghât Forests (Kutumpole) was commenced in 1870 and continued up to 1898. The attempt to raise teak was not very successful; the method of regeneration of these evergreen forests belongs to the work carried out after 1900. Attempts were also made to regenerate sandal artificially, and between 1880-3 an area of 15 acres was successfully planted with sandal at Karmad, and by 1898 over 500 acres of sandal plantations existed. The

sandal here, as in Mysore and all the sandal areas, suffered throughout the period from the serious disease known as "spike." Efforts to deal with this pest proved ineffectual and its scientific cause remained unknown.

The Forests of Coorg were first alluded to as a Forest Division in 1876-7. An administration report being drawn up by Van Someren, Conservator of Mysore and Coorg. The receipts for that year were Rs.76,000 and expenditure Rs.33,000. In 1878-9 the Annual Report for the Province was prepared by Mr. F. B. Dickinson, Conservator in charge, and the Department in Coorg severed its relations with the Mysore Conservator. The staff was increased by a Sub-Assistant Conservator. In 1879-80 the revenue and expenditure were Rs.1,00,000 and Rs.55,000 respectively, and in 1899-1900 Rs.1,62,410 and Rs.88,190; the total forest area under the Department being 899 square miles or 56.82 per cent of the country.

The first working plan (that for the Hatgat and Nalkeri Reserves) was prepared in 1886; it was followed by plans for part of the Dubare Reserve in 1892, for the Anckad and Athur Reserves in 1894, for the whole of the Dubare and Arkeri Reserves in 1898 and for the Devamachi and Mawkal Reserves in 1899. The plans prescribed selection and improvement fellings by area. The fellings were made, but as was the common practice at the time, they were practically restricted to the saleable timber, i.e. the best trees in the forests, and improvement fellings to favour the young crop were not made. By the close of the century an area of 178 square miles was under Working Plans, others were under preparation for 22 square miles, whilst 699 square miles were without Working Plans.

CHAPTER II

THE PROGRESS OF FOREST CONSERVANCY IN THE BOMBAY PRESIDENCY, INCLUDING SIND, 1871-1900

THE somewhat slow progress made in introducing a proper conservancy of the forests in Bombay and the position arrived at by 1870 has been detailed in Chapter IV of Volume II. Some of the difficulties were dealt with by the Secretary of State in a despatch alluded to on pages 163-4. It will be remembered that Brandis visited the Presidency in the winter of 1869-70. At that time the Conservator was little more than an Inspecting Officer, having no real control over the Forest Officers of the Department. Subsequent to Brandis' visit this anomalous position was rectified and the authority of the Conservator in his Department brought into line with the practice in the provinces under the Government of India.

Both in Bombay and elsewhere it soon became apparent that the forest areas to be dealt with were far too extensive to form the charge of a single Conservator and the former took the initiative and created three Conservatorships in the Presidency in 1873, a northern and southern for Bombay and a third in the Sind Province. This was a step in the right direction, but unfortunately serious financial stringency was caused by the bad famine of 1876-7 and 1877-8 which brought about stagnation in trade and consequently a falling off in demand for forest produce. The progress made with demarcating the Forest Reserves, rendered all the more necessary owing to the peculiar position of the forests relatively to those of foreign States and private individuals, was slow and troublesome, and some of the difficulties were undoubtedly unfortunately due to the Forest Officers themselves; although the records show unmistakably that their work was often rendered more arduous by the opposition of the Civil Officers. Shuttleworth was appointed Conservator on the retirement of Dalzell in September, 1869. After the division of the Presidency Shuttleworth became Conservator of the Northern Division, and in this

position did not in all things fulfil the high promise he had shown as a Deputy Conservator.

The Annual Reports and other Memoranda for the years 1876-7-8 show clearly the position into which the forest policy and management was again drifting. The new Forest Act VII of 1878 had been made applicable to Bombay (II, 469), but the Rules to be made for the Presidency under the Act were still under consideration. Under the revised distribution of the forests brought about by the division of the Presidency into three Conservatorships (including Sind) the Northern Conservatorship included the forests in the Collectorate of Thana, Kolába, Ratnágiri, Khandesh, Násik, Ahmednagar, Poona, Satara, Sholapur, Surat and Kaira. These Collectorates were under the Commissioners of the Northern, Central and Southern Divisions (Ratnágiri only in the latter), each of whom was empowered to express his opinion in Memoranda upon the Conservator's Annual Forest Report before it reached the Bombay Government. The Southern Conservatorship which was under Colonel Peyton included the forests of the four districts, Kanara, Belgaum, Dharwar and Kaládgi, all under the Commissioner of the Southern Division. As has been customary in this history, the Sind Forests will be treated of separately.

The Government review of the position of the Forest Department in the Presidency in 1878 states that the Department had been making a slow headway against considerable difficulties and that greater progress had been made during the past year, in spite of the serious set-back to sales due to the two years of bad famine, than at any previous time. It was held that the application to the Presidency of the new Forest Act would greatly facilitate the work of the Department.

In the Northern Conservatorship Shuttleworth now had a strong body of good officers, some of whom were to leave their mark on the annals of forestry progress in the years to come—as will be evident by an enumeration of their names. Messrs. Gibson, Betham, Horsley, Wroughton, Hight, Wallinger, Mainwaring, Fry, Dunbar, Talbot and Fagan, most of whom had been trained at home. Bombay had soon departed from the position they at first took up as regards recruiting trained officers. Several of the above officers were destined to become in their turn Conservators in the Presidency, whilst one of them, Mr. Wroughton, subsequently became Inspector-General of Forests.

The chief matters preoccupying the Department in the Northern Division may be classified as demarcation of Reserves, the question of grass and grazing rendered so important owing to the famine, the free grant of wood, and plantation and sowing work. In many districts friction was apparent in connection with the first three, and the unfortunate attitude taken up by Shuttleworth was inevitably reflected in some cases in the actions of his officers. Progress in demarcation had been interrupted by the famine, as so many Assistant Collectors had to be delegated on famine duty, and under existing orders the presence of an Assistant Collector working in conjunction with the Forest Officer was necessary where new areas were being selected for formation into Reserves. In spite of this the area of Forest Reserves rose from 4022 square miles in 1876-7 to 4407 in 1877-8, the additions made being 350 square miles in Khandesh, 32 in Poona, 2 in Sholapur and smaller portions in Thána and Kolába. "Much remained," said the Bombay Government (Resolution dated 11th March, 1879), "in the two last-named districts and Ratnágiri, as well as in several others, and the issue and publication of lists of Reserved Forests under the new Act will probably go a long way to satisfy the demands of the Conservator on behalf of his Department."

The controversy over the grass and grazing question covers much of the old ground of the past with one new factor. Under the pressure of the famine the Department had undertaken the work of cutting and baling the grass to be utilized as fodder for the cattle. The people would not, however, buy the cut and stacked hay, stating that the cattle would not eat it, and the work was stopped. The conservative nature of the ryot is well known, but in the existing state of unpopularity of the Department in many districts it is difficult to say at this length of time whether the steps taken were such as to induce the people to try the new departure. As an outcome, Shuttleworth drew attention to the large amount of grass which was allowed to remain and rot in the forests. The Commissioner of the Northern Division in commenting upon this remark said that during the last ten or twelve years the grass lands of the Presidency had been more and more transferred to the Forest Department, until in places the Department had a monopoly. The Commissioner had himself always considered this a mistake. He was of opinion that large areas of grass land for the people should have been left outside the charge of the

Department, but he did not explain why the people refused to make use of the grass within the areas under the Department, merely stating that this was the case. The Commissioner of the Central Circle makes similar remarks, but he adds that thousands of cattle went to the forests (owing to the famine), but comparatively few went back as the dry grass in the forests was not worth eating. As is well known during severe famine conditions large numbers of the miserable type of Indian village cattle are inevitably doomed under a feeding system which depends entirely on grazing. Nevertheless the conflicting opinions did not make for the harmonious progress of the Department.

Another cause of friction also supervened. The Conservator objected to free grants of wood to cultivators even of the poorer type, such as Bhils and the like. Several of his officers acting, it may be imagined, under his orders had endeavoured to enforce his views and been overruled by the Collectors. The difficulties concerned with the collection of fees on forest produce and so forth in Bombay have been previously dealt with in this history and had caused the Department unending worry. But it is difficult to justify the position taken up on this point. The very people they objected to giving free wood to were those they should have been making their friends with a view to ensuring their co-operation in forest work. And the whole sum involved was a petty Rs.1,100 per district. In their Resolution the Bombay Government said that the question of free grants of timber would be considered after the Rules which were being framed under the Forest Act had been discussed and sanctioned. But, as a result of the unsatisfactory position of the grass and grazing question and the free grants, the prosecutions for theft and trespass were already assuming an unenviable position in the Forest Officer's daily work, making him regarded rather as a police officer than as a real friend of the people, his proper sphere in the administration of the countryside.

The question of forming plantations in the Presidency, especially to assist the fuel-supply question, was dealt with at length in a previous part. This work was making headway, and considerable success was said to have been attained during the year with broadcast sowing. The three systems being adopted were: (1) Rearing seedlings in nurseries and then planting them out in pits in the forest; (2) Ploughing and digging up land and sowing seed thickly (under this plan, a thinning of the seedlings had often been necessary before the

plants established themselves); (3) Sowing broadcast and protecting the areas sown against man and animals. The first method was considered to be only applicable to small areas favourably situated and with a good soil. The second system was pursued on comparatively flat lands and on banks of streams and rivers where the soil was deep, i.e. the *babul* (*Acacia arabica*) Reserves in the Deccan and Konkan. The plan was also expensive. Shuttleworth considered broadcast sowing to be the only feasible plan for large areas and it had been carried out with great success, and was the system in his opinion for adoption in the *reboisement* of denuded hill-slopes. The Forest Guard was the main factor in this work. The Forest Guard collected the seed and sowed it and looked after the area in his "beat." Therefore the greater the staff of Forest Guards in suitable areas the greater would be the progress of the work! A rather optimistic opinion to hold perhaps when dealing with a totally untrained subordinate staff. This regeneration and planting work had two main sides. An example of the first was the fuel plantation adjoining the G.I.P. Railway. This was a *babul* (considered the best species for the work) plantation, the ground having been ploughed and sown. Seedlings raised from seed sown in 1874 were then 12 feet high. Other plantations contained teak (Rajwadi in Kolába district) with a little blackwood. Casuarina at Dapoli (Ratnágiri district) and so forth. The second example was the broadcasting method in the forest areas, adopted in many districts, the species used being *babul*, *anjan* (*Hardwickia binata*), *khair* (*Acacia Catechu*) and bamboos. In the review of this work it was suggested that greater attention should be paid to sowing bamboo, of which there was always a large demand, and it was added that the Department were not paying sufficient attention to the manufacture of charcoal, the demand for which was also large.

Under Colonel Peyton's admirable administration the progress of forestry work in the Southern Conservatorship appears to have advanced most satisfactorily. Perhaps the outstanding feature of it was the success achieved from his method of dealing with the collection and sale of myrobalans.

Peyton's officers at this time included Barrett, Laird and Talbot who had exchanged with Betham. As in the Northern Division, demarcation work here had suffered owing to the famine. The Government of Bombay's Resolution on Peyton's Report epitomises the work carried out and progress made.

" The only addition to forest reserves made in the past year was that in the Bidi taluka of Belgaum, amounting to 307 square miles. Other proposals are being prepared for the approval of Government. It is observed that in this Division (i.e. Conservatorship) gratuitous grants of timber were freely made to the poor cultivators on the Ghâts, and this liberality, coupled with the popularity arising from the departmental collection of " hirda " (myrobalans), the fruit of *Terminalia chebula* probably accounts for the marked diminution in the number and extent of forest fires and the readiness which the villagers showed in assisting to extinguish them when they did occur. Forest offences were also fewer, there having been only 164 cases as against 215 in 1876-7. Owing to the unfavourable season—the long break in the monsoon after the first showers fell, and the excessive rain in subsequent months—plantings were, except in the eastern districts, under the broadcast system and in the case of the Casuarina Plantation at Karwar, scarcely successful. . . . Attention may be drawn to the great success of Colonel Peyton's departmental collection of myrobalans (a success which is entirely due to his energy and forethought) and to the working of the Kanara Saw Mills, which despite the bad season made a net profit of Rs.3,848 and had in hand on 31st March, 1878, stock valued at Rs.54,881."

It should be mentioned that the extraction of timber, etc., from the forests of the Presidency was done by Departmental Agency and by sale to purchasers of trees standing in the forests. As regards the financial results of the year the Northern Conservatorship showed an unexpected and unexplained rise in receipts and a fall in expenditure from the amounts budgeted for. The Budget estimates were for Rs.3,94,919 and Rs.3,24,225 respectively. The actual figures were Rs.5,42,291 and Rs.3,06,527, with a net revenue of Rs.2,35,694 or 1½ lakhs over the anticipated amount. The increase was most marked in departmental operations, sales of firewood and charcoal and bamboo. Khandesh, Surat and Kolába were chiefly responsible for this satisfactory position. In the Southern Conservatorship the position was not so favourable, only the myrobalan sales averting what would have possibly proved a deficit. Here the Budget estimates were for Rs.5,13,882 in receipts and Rs.3,15,326 expenditure, but the actuals were Rs.3,52,817 and Rs.2,79,353 respectively, with a surplus of Rs.73,462 only. As might have been expected the decrease in revenue was greatest in Kanara, Rs.1,37,350, and was due there to departmental operations in timber and bamboos.

The departmental collection of myrobalans (the fruit of *Terminalia chebula* used for tanning) was started on a small

scale in 1874-5 by Peyton at the request of the hill people. This minor product was an important item of the forest produce of Belgaum and Kanara. The right of collection of the fruits in the forests had been farmed in the various talukas since 1869-70 in Belgaum, and, in the two districts, since 1870-1. The small amounts collected departmentally from 1874 onwards to 1876-7 were shown in the accounts in the farm revenue for this product. The total sum realised from the farmers fluctuated a little, but Peyton satisfied himself that Government were not receiving the true value of this product owing to probable collusion of smaller officials and a ring amongst the farmers. He accordingly took the bold step of undertaking the whole of the collection from the forests through the local people departmentally during 1877-8 for the first time. In this manner he secured other benefits, especially great assistance in fire protection. The financial result was startling, as the following well shows: From 1870-1 to 1876-7 the right to collect sold on an average for Rs.24,883. In 1877-8 the departmental collection gave a *net* increase of (receipts Rs.1,17,038, expenses Rs.44,728) Rs.76,966, showing a balance in favour of 1877-8 of Rs.52,083. The increase from this product had trebled in one year and it was estimated that the net profit the following year would be a lakh of rupees, as the absence of the usual fires had produced a marked effect on the myrobalan crop. The local people had, of course, been the first to realize this. Referring to the new departure and its remarkable outcome Peyton prophetically remarks: "Doubtless there are all over India similar mines from which an enormous and like legitimate forest revenue might be expected, but if they are to be worked successfully, Forest Officers must not shrink from the closest personal examination of them, and, in assuming control or replacing whatever contract system may exist, secure to the collectors or pickers of the produce good and liberal rates far exceeding those of contractors."

In 1881 Brandis visited Bombay at the instigation of the Government of that Presidency. He toured in parts of the Deccan. One of the objects of the visit was the question of arriving at a decision on the classification of the forest areas. Brandis advocated the division of the hill reserves into two classes—the one class to be strictly protected against unauthorized felling, grazing and fires, whilst in the second class grazing was to be permitted on payment, the burning of the forests, however, to be prohibited. The object Brandis aimed at was to

make an effort to reduce the state of affairs which had developed in the Presidency under which the Forest Officer was drifting into the position of a policeman-*chaukidar* (watchman) in the forests, the greater part of his time and energies being occupied in impounding cattle or prosecuting offenders. Realizing the difficulties, Brandis' idea was that by giving effect to his proposals the best forest areas would receive protection by adequate closure, and a reduction in the forest police work would follow.

Forest conservancy in the Presidency did not move on smooth wheels during the next decade. Matters had become so unsatisfactory in the Northern Division, especially in the Northern Konkan, and the complaints of the ryots backed by influential public opinion, voiced by a body termed the Thana Forestry Association (whose origin could not be traced), so clamorous that in 1885 the Government of Bombay determined to appoint a Commission of Enquiry. This step was strongly advocated by the past and the then Secretary of State (the Earl of Kimberley and Lord Randolph Churchill) and by the Viceroy (Lord Dufferin). Although the scope of the enquiry covered the two districts of Thana and Kolába (the Northern Konkan) only, the questions raised and the policy discussed were to a great extent relevant to many of the districts of the Presidency. The Commission was appointed in Government Resolution, Rev. Dept., No. 5977 of the 24th July, 1885, and four voluminous Blue Books entitled "Report of the Bombay Forest Commission" were issued in 1887. The enquiry covered the whole known history of the forests of Thana and Kolába and presents the position of forest conservancy at the time and the causes which had brought about the existing position. It is impossible to do more than glance briefly at the recommendations of the Commission. The Chairman of the Commission was Mr. G. V. Vidal, Collector of Thana, and the Members: Rao Saheb Ramichandra Trimbak Acharya, Rao Babadur Krishnaji Lakhsman Nulkar, Mr. E. C. Ozanne, C.S., Lt.-Col. W. Peyton, Conservator of Forests, Mr. R. C. Wroughton, Deputy Conservator, and Rao Bahadur Yeshvant Moreshvar Kelkar. The latter also acted as Secretary. The opening paragraph of the Government Resolution appointing the Commission was as follows: "The Governor in Council—wishing to secure an efficient management of forests and believing that the conservancy of forests and the maintenance of the rights of the Crown is beneficial to the interests of the

people in providing for a continuous supply of timber ; wishing to secure the agricultural wants of the people and the privileges they have hitherto enjoyed for the legitimate fulfilment of these wants ; convinced that whatever friction has arisen in the management of forests, especially in Thana, such friction is due to a misunderstanding which can be removed ; desirous to give to all parties concerned the means of bringing their views before Government—institutes a Commission.” The scope of the enquiry was to be mainly directed to hearing and resolving complaints, considering the best manner in which the wants of resident agriculturists as distinct from trade demands, could provide for, to the position of the wild tribes in the matter of employment and their well-being generally, to the suggestion of means for educating the people on the subject of the value of forest conservancy and securing their hearty co-operation and to determine the necessity of *ráb* cultivation or otherwise. Lastly, the warning was added that the Commission should not lose sight of the fact that forest settlements were in progress, that the respective areas of Reserved and Protected Forests were not yet settled, and that the effect of the introduction of Working Plans on the supply of forest produce was still unknown.

It will be obvious that the scope of the enquiry laid down was admirable. The task laid upon the Commission was an extraordinarily difficult one, and it must be conceded that they approached it with great thoroughness. That the future outcome of their recommendations was not to achieve the success aimed at must primarily be laid to the door of the very unsatisfactory position into which the matter of forest conservancy had drifted, to the unwillingness of the Bombay Government to interfere with established, though pernicious, customs of the population, to the contradictory nature of the orders and restrictions issued from time to time by the Government and the contradiction in terms used by Settlement Officers in their reports—all of which are commented upon at length in the Report of the Commission. To emphasize the difficulties, the Commission preface their conclusions with the remark : “ It must be remembered that the grievances we have had to enquire into do not merely refer to single recent acts restricting this or that local privilege but to the whole policy of Government as regards trees and the user of forests and waste lands, as pursued for a great number of years past. The complaints are not limited, as might be supposed, to the administration of the forests under

the comparatively recent Act of 1878. Some complaints date as far back as the year 1839, when the prohibition against cutting teak in forest lands was first issued (Vol. I, p. 86), or it may be, reaffirmed."

The preceding parts of this history will have disclosed the lines upon which the introduction of forest conservancy in the Presidency had proceeded. The lines of the investigation and the treatment in the Report of the Commission therefore naturally fall into the Sections: Grazing, Timber, Firewood and Bamboo Exploitation; *Ráb*; Minor Forest Produce; Free Grants of Wood; Wild Tribes; Trees in Occupied Lands; Claims to Fruit Trees in Waste Lands; Rules under Section 41 of the Forest Act; Forest Offences and Abuses of Privileges; Forest Establishments and Trade.

The chief causes of discontent on the part of the population were connected with grazing, *ráb*, free grants of wood and the sale of trees on occupied lands. The grievances of the wild tribes were of a minor character and due to the failure on the part of the Forest Officer to gain them over to his side, which Peyton's treatment of them in the Southern Circle had succeeded in doing.

The Grazing Question. Perhaps one of the chief causes of the complaints against the forest department was the position of the grazing question. This had become very complex. It may be briefly reviewed: The old Settlement Reports of the different talukas made no special mention of the assignment of lands for grazing or other purposes. The records of the Revenue Survey between 1854 and 1876 showed in detail how the waste lands of each village were then treated and the uses to which they were assigned. But the remarks in this connection presented an extraordinary variety of expression in the words used to convey apparently identical meanings. The presumption was that the work being done by different officers, without previous consultation, the verbal distinctions crept in unwittingly.

Some of the waste lands were set apart exclusively for forests; some for forests and grazing combined, the grazing being in most cases declared free, and in a few cases available only on payment; some for free grazing alone; some for sale of pasturage or grass; and others for no specified purpose. This differentiation would have been clear enough had it not been for the looseness with which various vernacular terms were used. The Commission allude to this difficulty as follows: "In the case of lands assigned for grazing in Thana, whether exclusively or in combination with forest conservancy, that in some instances the word 'mophat' (free) is inserted while in others it is omitted. It has been contended th at

the entry of this word in some cases implies that its omission in others was *intentional*; or in other words, that while *free* grazing was promised in certain lands, grazing only was guaranteed as regarding other similar lands, without any promise that it should be enjoyed free. Taking into consideration the manner in which these entries have evidently been made, we cannot believe that the Survey Officers intended that there should be any distinction whatever between the lands described as '*gurcharnikade*' or '*gure charavi*' and others similar in all respects described as '*gurcharnikade mophat*' and '*gure mophat charavi*.' When it was customary that the grazing should be sold, and it was intended that that custom should be continued, the land is either called '*Kuran*' or '*vancharai*,' with or without additional words referring to disposal by auction, or else without being described as '*Kuran*' or '*vancharai*,' an express direction is given to sell the grazing by auction. The word '*gurcharan*,' like the word '*gairan*,' clearly refers to *free* grazing only, and is always understood in this sense. In Government Resolution on grazing No. 7467 of 15th September, 1885, '*gairan*' is used thus as denoting *free* grazing. When the word '*gairan*' or its exact equivalent '*gurcharan*,' is used the addition of any word, such as '*mophat*,' signifying '*gratis*,' is redundant, and unnecessary, and its omission is of no importance. Thus '*gurcharan*' and '*gurcharni kade mophat*,' as used in the Survey Registers, are expressions of precisely similar import. Nor do we consider that even where the particular word '*gurcharan*' is not used, any distinction was meant to be made between lands assigned respectively for grazing under the entries '*gure charavi*' and '*gure mophat charavi*,' because we believe, as above stated, that where it was intended to sell the grass or grazing of any land, either an express direction was given to do so, or else the land was described as '*Kuran*' or '*vancharai*,' terms clearly implying such intention."

It was indisputably the custom previous to the Survey that all unappropriated and unreserved waste lands were used by the people for free grazing. In lieu of these undefined and shifting areas the Survey assigned, wherever available, special areas in each village for free grazing for the cattle of that village, no portion of which land could be appropriated for cultivation or other purpose without the sanction of the Revenue Commissioner. The proportion of land so assigned to the total waste lands in Thana could not be ascertained by the Commission, as in the course of the demarcation of the forest lands which was carried on from time to time between the introduction of the Survey and the passing of the Forest Act of 1878 certain areas of land previously assigned for free grazing were included together with the unassigned waste lands in Imperial Reserves and removed from the list of free grazing lands, and new entries to this effect were made in the registers, the old ones being destroyed. When free grazing lands were converted

large areas of old free pasture had been wrongly included within forest limits, and secondly, that the inhabitants of villages having no forest within their limits were no longer allowed to graze their cattle free, according to former custom, in the pasture lands of other villages.

The main quandary of the Forest Department would appear to have been that as they had not commenced the preparation of working plans the forests were not divided into units of working ; consequently they were unable to say exactly what areas they would wish to close entirely to grazing and so had to fall back on generalities—always a weak position to have to assume. It must be admitted, in fairness to all parties—the Civil Officer, the Forest Officer and the villager alike—that by 1885 the position had become an impossible one.

The recommendations of the Commission were briefly as follows : Residents of forest villages should be allowed to graze their cattle and cut grass for their own use free in the unclosed portion of the forest block, in which are enclosed any or all of the forest lands of their villages. This would give a common rule of procedure, easily understood by the people, for all alike. The privilege to be extended to all who cultivated land within the village, whether resident there or not. As regards the number of cattle to be grazed per village, the Commission is interesting on the subject, but their remarks can be only briefly alluded to. They obtained the views of other Provinces in this connection. They also established the fact that there had been no great decrease in the cattle owing to the closing of the forests in 1879, an argument which had been brought forward. In 1873-4 the total head of cattle in Thana was 361,662, in 1885-6, 355,838. They considered that this number was needed for the proper cultivation of the area annually cropped. The question as to whether any restriction in numbers would subsequently be necessary could be left to the future. In the case of non-forest villagers, they considered that they should pay a moderate fee for grazing their cattle in forest lands. As regards cattle-breeders, they should pay higher fees and only be admitted if there was room for them without hardship to the local villager.

That the agricultural problems connected with grazing and *ráb* cultivation were causing lively concern to the Viceroy, the Secretary of State and to the Governor of Bombay (Lord Reay) is proved by the hopes they based upon the work of the Commission. In his opening address to the Commission the Governor said :

“ Agricultural problems have always struck me as peculiarly interesting, and the more one looks into the various agricultural systems of various countries the more one becomes convinced

that over-legislation in agricultural matters is a mistake, and that in the present condition of agricultural science, which is not by any means as far advanced as it ought to be, we must be careful to interfere as little as possible. . . . Local wants, local customs and local systems of village tenure have a right not to be wantonly disturbed unless a very good cause be shown for it. In many instances a scientific justification for local agricultural practices unconsciously observed by the people will be forthcoming. . . ." In his speech on the Indian Budget the Secretary of State asked the question : " How are you, on the one hand, to obtain the most desirable objects of preserving and renewing the forests without, on the other hand, entailing hardships on the people by depriving them of valuable and long-established rights ? That is the question which has constantly presented itself to me. I believe, however, that if forest conservancy tends to increase the supply of fodder and fuel for the people of this country, the enterprise will meet with their support, and has a right to their sympathy."

Ráb.—The *ráb* cultivation was one of the chief questions before the Commission. The word "*ráb*" literally only means "cultivation," but in practice it had come to denote the prevailing practice of burning the rice seed bed and was also used to denote the material burnt. In the Northern Konkan rice always continuously, and *nágli* (*Eleusine coracana*) and *vari* (*Panicum miliare*) in rotation with other crops and intervening fallows, were grown from seedlings raised in a thickly sown nursery, usually prepared by burning layers of cow-dung, tree loppings, shrubs, leaves, grass and clay in various combinations. Rice was grown in other parts of the Presidency, both with and without *ráb*, the latter method being the commonest in most parts of India. The loppings of trees and shrubs used for *ráb* cultivation were termed *tahal* or *shindad*. The findings of the Commissioners on this practice and its continuance were as follows :

" (1) That *ráb* as practised in the Northern Konkan is good farming. . . . (2) That there appears no reasonable prospect of replacing *ráb* by a cheaper artificial manure, or by any method of cultivation customary in other parts of India or elsewhere. (3) That without first exhausting the available supply of cow-dung, shrubs and brushwood, for the principal layer, the use of loppings from valuable timber trees for *ráb* is unwise ; that therefore in the best interests of the ryot and of forest conservancy the State should as far as practicable, insist on the full utilization of cow-dung, shrubs and brushwood, before recourse is had to trees which are valuable for timber and firewood."

The Commission expressed the opinion that the supply of grass,

leaves and loppings was not at present in excess of the requirements of this *rāb* cultivation, which was confined to the better class of low lying lands, as opposed to the *varkas* or hill lands where the other forms of cultivation obtained. They agreed that although lopping valuable trees was detrimental to forest conservancy it was perhaps a fortunate circumstance that only those forest lands which were situated within a very short distance of the cultivated fields could be profitably exploited for *rāb* material; the average weight of this material to produce seedlings for an acre of rice being found by experiment to be about 4 tons, and that therefore it did not pay to carry *rāb* for more than a few miles. It is impossible here to follow the Commissioners through all their arguments, with which the Forest Officers were not in agreement. Wroughton wrote a Memorandum of dissent with the Report on this head; whilst an Indian Commissioner dissented on the ground that its recommendations did not go far enough in the interests of the cultivators. It is easy to estimate the difficulties, the certainty of considerable friction with the population (for the question was very freely discussed in the Press) if the practice was put an end to, and the firm conviction of some of the members of the Commission that *rāb* was an absolute necessity to rice cultivation. The inevitable compromise was therefore adopted and the continuance of the practice of taking loppings from certain species of trees from the unclosed portions of the forests to make up the deficiency of the *rāb* supply was granted to the residents and cultivators of forest villages as a temporary privilege and until further orders, in addition to the privilege already enjoyed of removing grass, reeds, leaves, shrubs and brushwood from the same areas. They were also allowed to remove grass from the closed portions of the forest. It was an unfortunate settlement of the matter, or failure to settle it, as it meant further destruction of the forests and an inevitable re-opening of the subject, which would certainly not become easier of settlement. In defence of their proposals, the Commissioners pointed out that when the Collector submitted the list of forest lands in Thana for notification in 1879, he anticipated that only so much of the Protected Forest as was in excess of the area necessary for the exercise of forest privileges would be finally included in the Reserved Forest. This it was held had been the principle which had guided all former demarcations, viz.: the demarcation of the forest lands into two classes, on one of which the wants of the residents would be a first charge, while the other would be held free of all local obligations. In 1882, however, a Committee of Revenue and Forest Officers had assembled at Thana to consider various forest questions pressing for settlement. The results of these recommendations so far as they affected the *rāb* supply were briefly as follows: All hill ranges and large forest blocks should be constituted Reserved Forests and not be divided into Reserved and

Protected Forests as had been the procedure, only smaller detached areas to be constituted Protected Forest. In other words, the question of local supply was no longer to be the chief factor in the demarcation. The Committee considered that loppings (*tahal*) were not absolutely necessary as manure for nurseries, and that cow-dung was preferred by the better and more industrious cultivators. That with the exception of loppings permission should be accorded to collect the other materials from the unclosed portions of the forests—that where these were insufficient the Department should provide depots from which the cultivators could make up their deficiencies on payment of moderate fees. It was recognized that the proper conservancy of the forests would be impossible were the *tahal* system to be continued. Moreover, there was another aspect of the question. Cultivators with trees standing on their own lands had for years been in the habit of selling these to contractors under permission granted in various settlements (though such permission had often been at variance with the standing orders of Government), and thus reducing the amounts of *tahal* available on their own lands and then resorting to the Government forests. Owing to the great diminution of trees on the agricultural lands the pressure upon the forests had become correspondingly great. The recommendations of the Committee were generally approved by the Government (Resolution No. 1203 of 14th February, 1883) in the words, "The lopping of trees cannot be allowed, nor is there any reason why the inhabitants of villages in which no lands are included in forests should be permitted to take *rāb* materials from the Government forests. The cultivators of this latter class of villages must procure their *rāb* from their own *varkas* or other lands; they clearly have no claim to collect it from Government forests." The findings of this Committee and the orders of Government were at variance with the proposals of the Commission in this matter.

Other Forest Produce.—On the subject of trees on occupied lands the right to which had been reserved by Government (royal trees of former Governments) the Commission proposed, in the interests of the *rāb* cultivation, that with the object of encouraging the preservation of such trees (to provide loppings) as a *permanent* source of supply that Government should waive their royalty rights, making over their rights to the cultivators of such land, with or without payment, with the stipulation that the trees were not to be sold to contractors, but to be solely used for agricultural purposes. The Commissioners definitely state their opinion that once the people owned the proprietary right in the trees they would be interested in their protection and maintenance. It showed very little acquaintance with the improvident habits of the people *vis-à-vis* tree growth, or of their likelihood to withstand a tempting offer of a timber contractor.

As regards other forest produce, the Commission recorded that headloads of branchwood for fuel purposes should be removable free (for barter, sale or consumption) from the special annual cuttings by villagers and all poor inhabitants only. They should be able to cut bamboos for their *bona fide* requirements from the unclosed parts of the forests free and "without any description of passes"—a most dangerous permission. With the exception of the minor products *hirda* and *beheda* nuts (*Terminalia chebula* and *bellerica*) and *mowra* (*Bassia latifolia*) flowers, villagers were to be allowed to collect free of charge for use, barter, or sale all unreserved and unfarmed minor produce such as fruits, leaves, bark, herbs and roots for medicinal or religious purposes. This suggestion affords sufficient evidence of the ignorance existing at the period on the subject of the enormous potential value of the minor products of the Indian forests.

Finally, on this question of forest privileges the Commissioners say, "It will be observed that in dealing with forest privileges of all kinds we have made no distinction between Reserved and Protected Forests. We are very strongly of opinion that the same privileges should be allowed in all *open* compartments of the forests, whether Protected or Reserved. All rules as regards the exercise of local privileges should obviously be as simple and intelligible to the people as possible. Different sets of rules for different classes of forest will cause much unnecessary confusion."

The Report of this Commission presents a clear picture of the position into which forestry administration had drifted—a position directly assignable to the regrettable supineness of earlier Governments to face the question of a definite settlement of all rights and claims of the people within the forests and waste lands. The recommendations of the Commission were generally accepted by the Bombay Government and disposed of, so far as grazing and the supply of *ráb* were concerned, by a Resolution issued in 1889.

Progress during the remainder of the century was slow and, as will be shown, retarded by the failure of Government to reorganize the Staff of the Department on the lines introduced in other provinces.

The revenue, however, showed an upward trend, that of 1889–90 being the highest ever recorded in Bombay (save in 1885–6). For the former year the receipts were Rs.31,37,696 and the surplus Rs.13,67,005. It is on record that great activity was being displayed during the last decade of the century in bringing the forest areas under systematic management. The disastrous famine in the closing years brought about an inevitable decrease in the revenue, the figures for

1899-1900 being Rs.24,15,200 (the average of the preceding five years Rs.30,46,244) and the surplus Rs.2,86,770, the preceding five-year average having been Rs.10,64,622.

In the Northern Circle the preparation of Working Plans was mainly confined to Thana, where the system of coppice with standards was being introduced. The results of this change of system will be dealt with in a later Part.

In 1900 the total area of forest under the Department, including Sind, was 14,945 square miles, of which 13,695 square miles were Reserves (including 679 square miles of leased forest in the Dangs, Surat District) and 1250 square miles of Protected Forest. An area of 1334 square miles was under sanctioned Working Plans in 1900, whilst plans were being prepared for 6038 square miles. Plans had still to be taken in hand for 7574 square miles.

The complexity of the working of the forests of the Presidency has been described in previous parts of this history. Owing to the fact that the Government Forest areas were so intricately mixed up with native states and private lands it had always been held that forest administration in Bombay differed appreciably from that in other Provinces, and that therefore methods in force in, and comparisons with, the latter were of little practical use. And to a considerable extent this was undoubtedly true. But one of the outcomes showed itself in a comparatively larger subordinate staff being maintained in the Presidency with a large number of very poorly paid posts. The complaints against the honesty of the menial staff of the Department doubtless had a strong substratum of truth ; but the reason was to be found in the fact that they were worse paid than the lower grades of any other department—in fact they were not given a living wage. The Bombay Government had gradually recognized the position of affairs and, in 1888, in a letter No. 5451, dated 13th August, to the Government of India, submitting a scheme for the reorganization of the controlling Forest Staff in terms of the Government of India Circular No. 9 F., dated 2nd June, 1888, they mentioned that the question of the revision and reorganization of the Staff, from Rangers to Forest Guards, was under consideration and expressed the opinion that a liberal increase in pay should constitute an essential feature of the scheme. Nearly two years later the Bombay Government, in their letter No. 3453, dated 17th May, 1890, reported that an influential Committee had considered the subject, that their recommendations had been

accepted and were now forwarded for sanction to the Government of India. Since, as the outcome was to show, nearly a score of years were to elapse before a reorganization was given effect to, it is worth while giving here the tabular statement showing the strength of the subordinate staff in 1890 and the reorganization proposed :

Particulars.	Actual.		Proposed.	
	Number.	Cost.	Number.	Cost.
		Rs.		Rs.
Rangers	40	31,440	163	1,32,000
Foresters	145	48,720	108	36,600
Forest Guards	3253	3,23,616	3635	3,65,124
Depot, working plans, survey, etc.	Nil	Nil	265	38,064
Clerks	150	54,120	316	85,752
Office peons	131	12,516	184	17,844
Total, permanent	3719	4,70,412	4671	6,75,384
Foresters, Forest Guards, Depot Clerks, etc.	501	54,586	272	25,742
Total, temporary	501	54,586	272	25,742
Grand Total	4202	5,24,998	4943	7,01,126

The reply of the Government of India was unfavourable (No. 633 F, of 24th July, 1890). A reorganization of all Provincial Forest Departments was under consideration at the time, and this was given as the reason for deferring a consideration of the Bombay scheme ; it was added, however, that there was no prospect of its being sanctioned in its entirety.

Early in 1891 the Government of Bombay convened a second Committee to discuss the question, the Inspector-General of Forests (Ribbentrop) and some local Forest Officers being members. This Committee, as compared with the first, reduced the number of Rangers, increased the number of Foresters and Guards, but abolished the miscellaneous posts, retained the number of clerks, increased the number of peons and materially reduced both the temporary establishment and the total number of the staff proposed in the preceding year. In the following year the Government of India (Circular

No. 24 F., dated 2nd August, 1892) forwarded proposals drawn up by the Inspector-General of Forests. Briefly these were: Rangers, 102; Deputy Rangers (the grade did not exist in Bombay), 72; Foresters, 272; Forest Guards, 3590. This suggestion was declined by the Bombay Government. In December of the same year they explained that they were considering the subject of the classification of State Forests into: (a) forests proper, (b) fuel and fodder reserves, and (c) pastures, and that they proposed to address the Government of India in the matter shortly. The immediate result of this letter was that a scheme for the reorganization of the Executive Forest Service throughout India, but expressly excluding Bombay, was forwarded for the Secretary of State's sanction in Finance Dept. Despatch No. 148, dated 10th May, 1893. This melancholy episode for which, in the first instance, the Government of Bombay was certainly not to blame, that responsibility resting apparently with the Inspector-General of Forests, dragged on, and six years elapsed before the subject was again reopened, the Bombay Government addressing a letter, No. 1419, dated 23rd February, 1899, to the Government of India in which they stated that the strength of the Executive Forest Staff could not be determined until the reclassification of forest areas furnished information as to what tracts were to remain in charge of the Forest Department, and adding, "in the present financial difficulties Government sees no prospect of being able to provide, for several years to come, the provincial share of the expenditure required for the revision of forest establishments." In the following year, in Finance Department's Despatch, No. 297, dated 6th September, 1900, proposals for the revisions of the clerical establishment throughout India, again expressly excluding Bombay, were made to the Secretary of State. Thus we see Bombay isolated and her executive establishment denied that improvement in prospects, which was not only overdue, but the nonfulfilment of which seriously retarded the development of forestry progress.

SIND

As has been described in previous parts of this history, the chief sources of revenue of the Forest Department in Sind were originally the fuel supply of the Indus flotilla, to which had been added the demands of the Railway and Karachi Harbour Works.

By 1878 it was considered probable that the Sind forests were sufficiently extensive to be capable of supplying all possible demands of the Railway, whilst it was thought that, with the increased number of trains, the demand for fuel by the Indus flotilla would decrease. The Karachi Harbour Works still absorbed a considerable amount whilst a new, and what appeared would be an increasing, demand for fuel had arisen on the part of the Hyderabad Water Works. The Commissariat Department in Karachi were also to be supplied in the future by the Forest Department.

Allusion has been made in a previous part (Vol. II, p. 175) to the erosion trouble existing in Sind owing to the vagaries of the Indus resulting in constant changes in its channels. Owing to this habit areas of land, both forest and agricultural, were washed away in one quarter and accretions deposited elsewhere. The question as to the ownership of such accretions was often disputed and had to be settled by the Courts as between different Government Departments or between a Department and a private claimant. During the year 1877-8 the inundation period was the lowest on record, thereby restricting the area cultivated and causing interference with the work and receipts of the Government Departments. This was followed by very high floods in the ensuing cold-weather season, causing excessive erosion, the Forest Department losing 5284 acres of forest swept into the river. The following statement is of interest as depicting the fluctuating areas under the Department from this action. It shows the area lost and gained in the whole Province between 1874-5 and 1877-8.

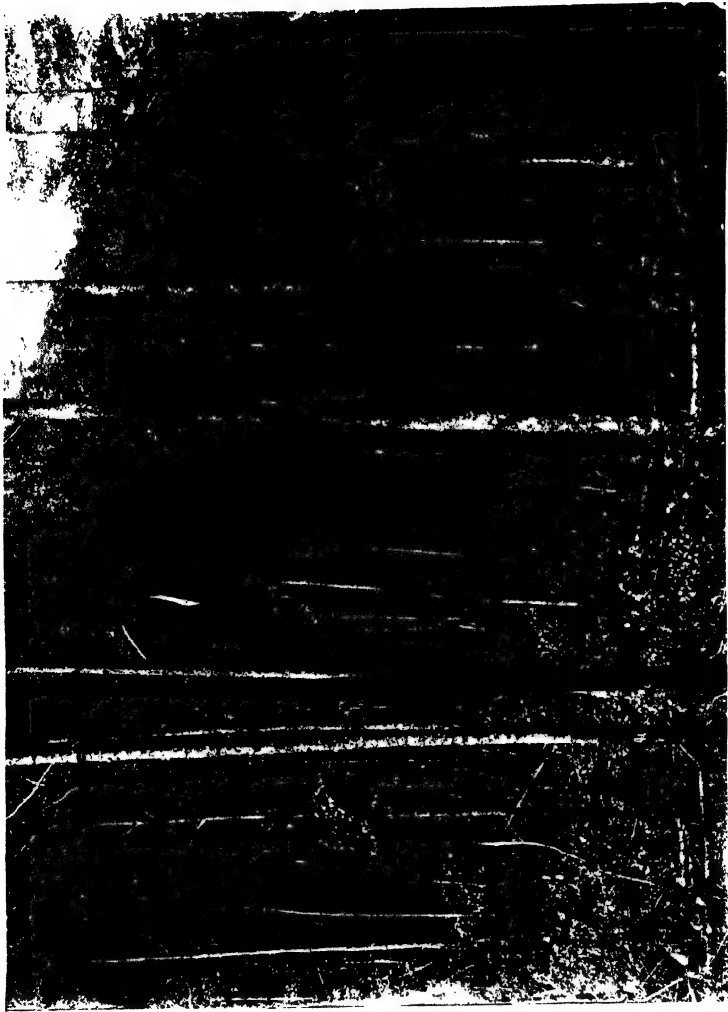
Years.	Lost.	Gained.	Net result.	
			Lost.	Gained.
	Acres.	Acres.	Acres.	Acres.
1874-5 . .	7204	17,120	—	9916
1875-6 . .	3272	6159	—	2887
1876-7 . .	5524	3780	1794	—
1877-8 . .	10,594	5310	5284	—
Total . .	26,594	32,369	7078	12,803

Major McRae was the Conservator of Forests and had introduced, for the first time in 1877-8, a new method of dealing with the trees, which had to be cut on banks which were being



EROSION STRIP, KALAMPUR FOREST, SETWAN RANGE, NAUSHAHRO DIVISION. THE INDUS WASHING AWAY THE FORESTS

Photo, by E. G. Oliver



ALNUS NEPALENSIS IN DARJILING FOREST, SAMPLE PLOT, NO. 9. E. HIMALAYA, BENGAL

Photo. by E. Marsden

eroded, with the object of saving a total loss of revenue from the threatened forest, and also to prevent as many of the trees as possible being swept into the river, where they became dangerous snags, holding up the sand and detritus, and impeding the navigation. It was usually difficult to dispose of the trees unless they were transported inland at a considerable expense. The Conservator had suggested stripping them of branches and roots and then dropping them into the river, where their weight, he argued, would cause them to sink in the mud at the bottom. The Commissioner, however, feared they might form snags, and would not assent to the suggestion, pointing out that the Forest Department did not pay anything towards the maintenance of the River Conservancy Department and, therefore, should commit no act which might increase the labours of this latter Department. McRae started this year the conversion of the trees on eroding banks into planks and scantlings *in situ* and the experiment had proved highly satisfactory.

On the subject of the important question of the ability of the forests to meet the requirements of the Indus Valley State Railway, the Commissioner of Sind, Mr. F. D. Melville, summarized the position in his Review (No. 3093, dated Karachi, 12th August, 1878) of the 1877-8 Forest Administration Report. The forests were under a so-called Working Plan (*vide* Vol. II, p. 175), but no detailed valuation surveys had been made. Mr. Melville wrote :

"It appears that only a total yield of 1,850,000 maunds of fuel, or about 66,000 tons will be required. The yield in the past year was 1,403,413 maunds. The highest estimate of the requirements of the Railway, which began at 10,000 tons, has now been fixed at 28,000 tons, based on a calculation of three trains both ways daily, with the consumption per train mile of 100 lbs. of wood, exclusive of the quantity held in reserve, which should be a two or three months' supply. This would require an increased yield of 784,000 maunds, and, therefore, the Conservator seems to have underestimated the requirements. But with an area of 343,336 acres of forest land, the Conservator considers that he would have no difficulty in meeting the demand. Major McRae, however, repeats his recommendation of a valuation survey, which has already been supported by the late Commissioner, and there can be no question that it would be the most satisfactory method of determining the forest capabilities of Sind. It is most probable that when the Railway is in full working order, the demand for fuel for steamers will be diminished ; and as a marked improvement in the system-

atic administration of Sind forests is observable, and the area of waste land (on which to form new forests) is unlimited, there need be no doubt that the requisite supply of fuel will be obtained without any contraction of the areas set apart for reproduction."

Under the Working Plan a third of each of the forests was closed to grazing. Owing to the scarcity and want of fodder in Lower Sind it had been necessary to throw open these areas in the Jerruck and Hyderabad Divisions to grazing (except to camels and goats). The reproduction was said to have attained sufficient height to be safe from damage by cattle. The Conservator proposed to modify the plan of closing one-third of each block at a time and to only enclose annually the area which had to be cleared and worked. He proposed to add to this area any adjacent land capable of producing tree growth. This would cheapen the cost of fencing by spreading it over several years, the work would be better done, and enable the reproduction to start at once ; also a more systematic method of cutting would be adopted and an opportunity be afforded for the collection of reliable data for determining the yield of the forests per acre. As has been already shown (Vol. I, p. 279), closed areas had to be fenced in this country, and the practice was well understood, since the old Mirs of Sind used to enclose their hunting areas with a view to obtaining a sufficient tree cover, for the protection of wild animals. The procedure of fencing to keep out cattle was therefore accepted by the people. Fire protection did not come so easily, however, and latterly bad fires had been experienced in Upper Sind. Since the cattle-owners were chiefly instrumental in causing the fires they were expelled from many of the forests. In this procedure the Conservator evidently had the support of his Commissioner (in fact the relations between the Civil and Forest Authorities were most cordial in Sind), for he writes :

" It is almost, if not quite, impossible to take a man red-handed in setting fire to a jungle or to get information ; but, I think, it is a safe plan to make the *máldahs* in a great measure responsible for fires, and I have very little doubt that good results will follow if the system of expelling *máldahs* from a forest, in which a special block has been burnt, and not letting them return unless they restore the burnt fences and clear a certain area of land as a protective belt is persisted in."

There were four forest divisions in Sind—Sukkur, Naushahro, Hyderabad (under the charge of Mr. Hexton) and Jerruck.

The ordinary methods of obtaining new crops was to fence in the land against cattle and keep out fire when the area became covered with crops of *bhan* (*Populus euphratica*) and *babul* (*Acacia arabica*).

In 1877-8 there were 60,611 acres in this condition. Artificial reproduction was almost entirely confined to Upper Sind (Sukkur, Naushahro and Hyderabad), where an area of 418 acres existed. Its necessity was said to be due to the prevalence of "flood, fire and frost." Mr. Dasai (the first Indian Officer trained at home, Vol. II, p. 54) was in charge of this work and was achieving a marked success. It will be remembered that Strettell had established this nursery and commenced experimenting with exotics (Vol. II, p. 174). In the Rahuja nursery at Sukkur Mr. Dasai had successfully raised the following exotics: Teak, *Terminalia tomentosa*, *Pterocarpus marsupium*, *Schleichera trijuga*; blackwood (*D. latifolia*), *Anogeissus latifolia*, *Ceratonia siliqua* and *Prosopis glandulosa*. The *Prosopis* had attained the extraordinary height of 10 feet in eight months from date of sowing. The teak and *Terminalia* were also growing remarkably fast. McRae did not think that teak would grow to any size, but said that if it would grow into pole size for boats on the Indus it would supply a demand, "there being no indigenous wood in Sind fit for the purpose." In the Hyderabad Division the bamboo plantations was doing well and expected to yield a crop of bamboos fit for the market the following year—i.e. four years after planting. The *Prosopis* had been subjected to the attacks of pig and porcupine, "and," says McRae, "as no fence will keep these animals out, I have protected the land with a mud wall." The total cost of the natural and artificial reproduction work during the year was Rs.15,900 for a total of 61,029 acres.

By the year 1877-8 the forest revenue of the Province, though not up to the sum included in the revised estimates, amounted to Rs.3,66,421, expenditure to Rs.2,71,291, with a net revenue of Rs.95,130.

During his tour of the Sind Forests in 1867-8 Brandis had recommended the establishment of depots for the sale of wood as likely to be remunerative (Vol. II, p. 174). Ten years later there were seven depots in existence—at Shikarpur, Sukkur, Rohri, Sehwan, Hyderabad, Kotri and Karachi.

During the five years 1873-4 to 1877-8 fuel had been supplied by the Department to (1) Indus Flotilla Company ;

(2) State Railway ; (3) Sind Railway ; (4) Commissioner's Steamer ; (5) Punjab Government Steamers ; (6) Indus Ferry Steamers ; (7) River Conservancy Dept. ; (8) Public Works Dept. ; (9) Karachi Harbour Works ; (10) Nawab of Bhawulpur's Steamer ; (11) Ice Factory, Karachi ; (12) Commissariat Dept., Hyderabad ; (13) Hyderabad Water Works. The total amounts supplied rose from 960,000 maunds during 1873-4 to 1,300,000 maunds in 1877-8.

In the *Review of Forest Administration for 1889-90* the Inspector-General states that no fresh cultivation of exotics had taken place and that it was said that the experiments had, on the whole, been a failure. In the following year it was reported that the survey of the Sind Forests, which had been undertaken by local surveyors and not by the Forest Survey, had proved of little value. The system in force in Sind, though not clearly described in the Circle Reports, appears to have still been clear felling with natural reproduction, both coppice and seed, under the direct influence of inundation water.

The Government of India's Resolution, No. 22 F., of 19th October, 1894 (*vide* II, p. 484), was involving some changes in classifications and settlements in Sind as elsewhere in Bombay. But the Inspector-General demurred at the disafforestation of some 60 square miles of Reserves in 1894-5. This area was given up for cultivation chiefly because it was said it could not be worked at a profit for the production of wood. It was pointed out that there was a growing demand for fuel both locally and in Baluchistan, and it was increasing in value.

A commencement was made with the preparation of Working Plans in 1896-7. The work had been impeded by demarcation operations which had to be first undertaken and subsequently by the incidence of the plague. Progress was being made in the Sukkur Division.

CHAPTER III

FOREST ADMINISTRATION IN BURMA AND THE ANDAMANS, 1871-1900

IN 1873 Mr. B. H. Baden-Powell, C.S., at the time officiating Inspector-General of Forests, made a tour of inspection in a part of the Burma Forests and compiled his observations and recommendations in a bulky report entitled *The Forest System of British Burma* (1874). In December-January (1875-6) Brandis (who had returned from furlough) visited Burma and drew up a briefer note on *Suggestions Regarding Forest Administration in British Burma* (1876). Brandis did not fully agree with Baden-Powell's suggested classification of the proposed Reserves, and in this connection and other matters he laid down a clear procedure, which he advocated, for the consideration of the Chief Commissioner of Burma.

From the review given in Chapter V of Volume III it will have been seen that progress in the work of demarcating and creating Reserves in all the good areas of teak in the Province had been slow, in spite of the anxiety expressed on this matter both by the Government of India and the Secretary of State. This work was regarded as the more urgent since these forests were still subject to *taungya* (shifting) cultivation by the Karens. Brandis' visit had for its main object the organization of this demarcation and reservation work, which, as he said, was the most important duty to be accomplished by the Forest Department.

In a Memorandum appended to Baden-Powell's Report Brandis had sketched the leading points which should serve as a guide in this question. The aim and object of forest conservancy in Burma, he considered, could be stated as follows: Permanently to maintain a forest area sufficient to furnish the requirements of the country and of the export trade in teak, catechu, *thitsee* (*Melanorrhæa usitata*), wood-oil and a large variety of other timbers and forest produce. The future

requirements of the country and export trade could not be foreseen at the time. As regards teak, the produce of Government Forests during the five years 1870-1 to 1874-5 had been on an average 45,290 tons a year, and the average imports from beyond the inland frontier (Upper Burma had not yet been annexed) during the same period had amounted to 110,278 tons. Of this quantity 103,288 tons had been exported by sea annually (from Rangoon and Moulmein), while 52,280 tons were consumed in the country (cp. table on p. 199, Vol. II). That represented the present requirements of the country and export trade in teak alone, and Brandis laid down that to assure the permanent production of a sufficient quantity would require at least 1200 square miles of well-stocked and well-cared-for teak forest. The Inspector-General said it was "idle to suppose that the demand for teak timber would not increase." He considered that the timber was not likely to be supplanted by iron or other woods, whilst the sources of possible supply were limited. The teak Reserves of India Proper were unlikely to be able to do more than supply the requirements of the country. The forests beyond the frontier (Upper Burma) and in Siam were being wastefully exploited, the quality of foreign timber coming into Moulmein having greatly deteriorated, whilst the teak in Java and Borneo was limited. Brandis recognized that there were fine teak forests at the head of the Meklong River, east and south of the British Forests on the Upper Thoungyeen, and there were extensive teak forests near the sources of the Menam River in the Chiengmay (Zimmé) territory. Bangkok was the outlet for these forests, but up to then the export of teak from these had not been considerable; and, though it might increase, Brandis did not think that Bangkok would enter into serious competition with Burma ports. And the extent of these countries (then unknown) was certainly less than the areas on the Salween, Sittang and Irrawaddy Rivers. Teak also existed on some of the feeders of the Cambodia River, but he did not think the export of teak from Saigon would ever be important.

Brandis possessed the invaluable gift of marshalling his facts in a most informative manner, and he has drawn an interesting and valuable picture of the existing position, and his reasons for considering that 1200 square miles of properly conserved good teak forest was the minimum which should be created as Permanent Reserves.

In addition, he pointed out that these proposed Reserves



TEAK TREE GROWN FROM STUMP OF TREE GIRDLED AND FELLED BETWEEN
1830 AND 1840, BURMA



TEAK TREES OF 1830-40 AT BITAKAT, SHOWING SPOOT-SHOOTS OF 24 SEASONS FROM TREE GIRDLED UNDER 7-6
CONDITION OF LEASE IN 1888-89, BURMA.

would yield large quantities of bamboo, other timbers and forest produce in addition to teak. It had also been acknowledged that it would be necessary to set apart additional tracts for the permanent yield of catechu, *thitsee*, wood-oil and of a great variety of valuable timbers, among which *thingan* (*Hopea odorata*), *padauk* (*Pterocarpus indicus*), *thitkado* (*Cedrela Toona*), *thitka* (*Pentace burmanica*), *pyinma* (*Lagerströmia Flos-Reginæ*), *engyin* (*Dipterocarpus tuberculatus*), *pynkado* (*Xylia dolabri-formis*), and *thitya* (*Shorea obtusa*) took first place.

In addition to these requirements Brandis agreed with Baden-Powell that for climatic and general reasons it was necessary to keep a large proportion of the hills well wooded, as their denudation would have a most injurious effect; though perhaps in Burma this argument was less apparent. He advocated the formation of a large Reserve north of Rangoon, extending from the head waters of the Hmaubee Khyoung to Oakhan, and comprising the hills between the Hline and Pounplin Rivers, comprising between 200 and 300 square miles. This would provide, although teak was scarce in it, a reserve of charcoal and firewood for the town. For similar reasons, and in order to maintain a supply of bamboos for the town, he suggested the formation of extensive Reserves on the hills between the Pounplin and Pegu Rivers and east of the Pegu River. It was not possible at the time to state what the aggregate of such Reserves in the different districts of Burma should be. That would have to be decided at a later date, district by district. But as most progress had been made, at the time, in demarcation work in that portion of the Thayetmyo, Prome and Henzada Districts situated between the Irrawaddy and the Yoma Range, in order to complete that work his suggestions related to that area.

Brandis did not agree with Baden-Powell's suggestion for the formation of two classes of Reserves, for several reasons; for one thing, they would be confusing to the people, to whom demarcation of forest lands was in itself a new feature of their everyday life. And the proposal to demarcate out areas in which *taungya* could only be undertaken could never work in practice as the Karens would never keep within them. He therefore suggested the formation of one class of Reserve only to be under the Forest Department, the forests outside the reserves to be District Forests under the control of the Civil Officers, teak alone in these latter forests remaining under the Forest Officers, as was the case at the time. This procedure

would be plain and simple, and readily understood by the people. In the present Reserves improvement would progress gradually on systematic lines, but it was too early to say in which of the Reserves such work should be commenced.

In the area proposed for demarcation of Reserves in the Thayetmyo, Prome and Tharrawaddy Districts an outer line running along the foot of the hills had already been agreed upon. Part of it from the frontier south to the Minhla River had been marked on the ground, and it was to be carried south as far as the boundary between Henzada and Rangoon. The forest situated between this outer line and the Yoma Range, an area of 930 square miles, was to be declared a Reserve under clauses 13-16 of the Forest Rules of 1865. It may be mentioned that Burma had two sets of rules to work by, those of 1865 and the new ones of November, 1875 (II. 469, 471). It was not intended to enforce all the provisions of the rules within the above-mentioned area. But the Department would be empowered to prevent any further extension of permanent cultivation, save in the case of old settlers residing in the immediate vicinity (either within or without) of the line, as well as the cutting of *taungyas*; also to prohibit the cutting of all reserved trees or the collection of their produce for trade. The main idea underlying the laying down of the outer line was to prevent the further immigration into the forests of squatters from the plains to undertake *taungya* cultivation in the valuable teak areas. This easy and lazy way of earning a livelihood appealed to the idle portion of the population (as had been the case in Madras). Numerous instances could be quoted as, e.g. the destruction of a large portion of the forest in the Shwaylay District in 1860 owing to the immigration of Burmese from the plains.

Before considering the suggested method of treatment of the forests within the line it will be necessary to mention that Brandis wished to conserve existing areas of forest situated in the plains without the line. Some of these had been already created Reserves or were under consideration. Including Brandis' proposals the total area amounted to 220 square miles situated between the Irrawaddy and the outer line. The reservation of these areas was not suggested mainly for their teak-bearing capacity, but for their general utility in providing for the requirements of the people of the plains. Brandis was not optimistic on this small area being able to furnish the future requirements of this population, once all the private forests had been cut out, but he remarked: "This

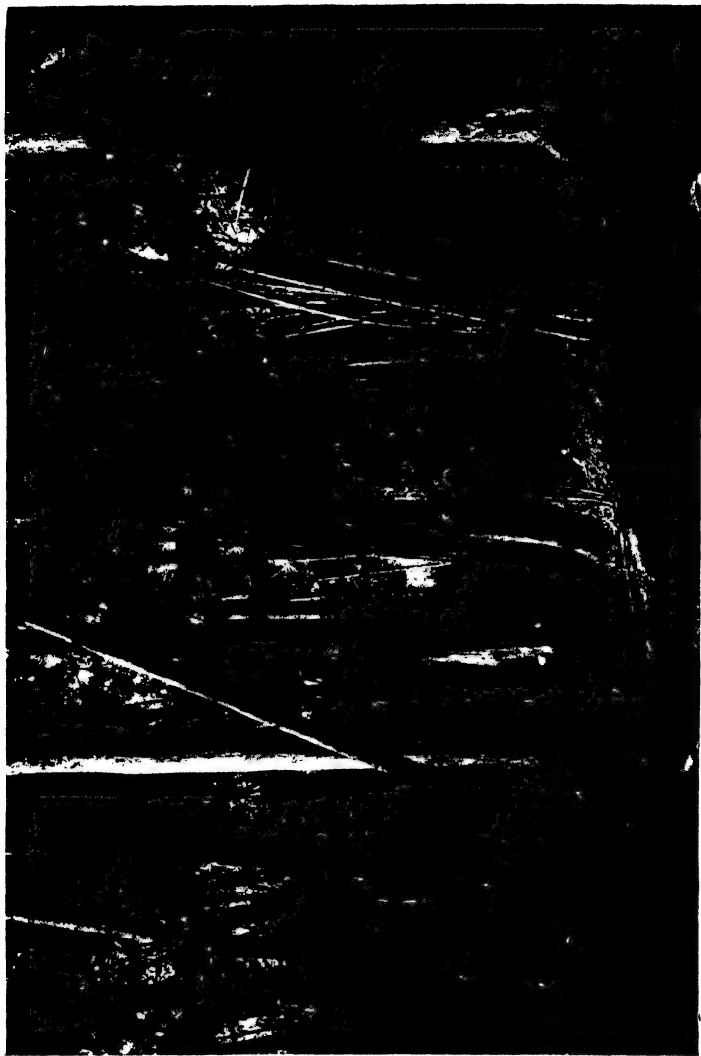
limited area of forest proposed to be reserved in the plains will be of incalculable value, when the railway is opened, if properly protected and improved."—And he suggested that a very much larger area might be taken up with advantage.

As regards the reservations within the outer line, the whole crux of the position lay with the Karen people and their method of livelihood by shifting cultivation (*taungya*). The Karens were indispensable in the forest. They were sometimes partners in the timber operations; they were employed to find the timber, devise the best dragging paths, in felling and lopping and so forth. They were intimately acquainted with the forests, and Seaton, the Conservator, had already induced them to plant teak in their *taungyas* (Vol. II, p. 209). It was obvious at the time that in all attempts to improve the forests by fire protection, sowings, creeper cutting, etc., the aid of the Karens would be indispensable to the Forest Staff. This was one side of the case. The other was the realization of the fact that save in a few instances the time had not arrived at which it could be hoped that the Karens would abandon shifting cultivation and settle down to a permanent form of agriculture. With these conflicting points to deal with it was realized that all good teak areas selected for Reserves must be closed entirely to *taungya* cutting. Three alternative methods were open : (1) Strict enforcement of the Forest Rules—properly relegated as out of the question. (2) Allotment of *taungya* grounds to the Karens for permanent cultivation—regarded as impracticable. (3) Select from the area the best teak localities and other valuable forests and demarcate them as Permanent Reserves from which *taungya* cultivation would be excluded. Brandis proposed the third method. To a slight degree it was complicated by the fact that Seaton, with the admirable object of getting the Karens to start planting teak in their *taungyas*, had inclined to the plan of assigning *taungya* lands to the Karens in return for the teak planted in their *taungyas*, and in some cases had promised to the Karens certain defined tracts of land if they planted a certain area with teak, and Government had sanctioned this step. The Demarcation and Settlement Officers, when selecting the proposed Reserves, would have to adjudicate on such areas, which would not be included within the Reserves. On this matter of teak planting in *taungyas* Brandis also laid down that no more work of this kind should be undertaken save within the areas to be reserved and fire protected. In the future, when necessary, *taungya* cultivation

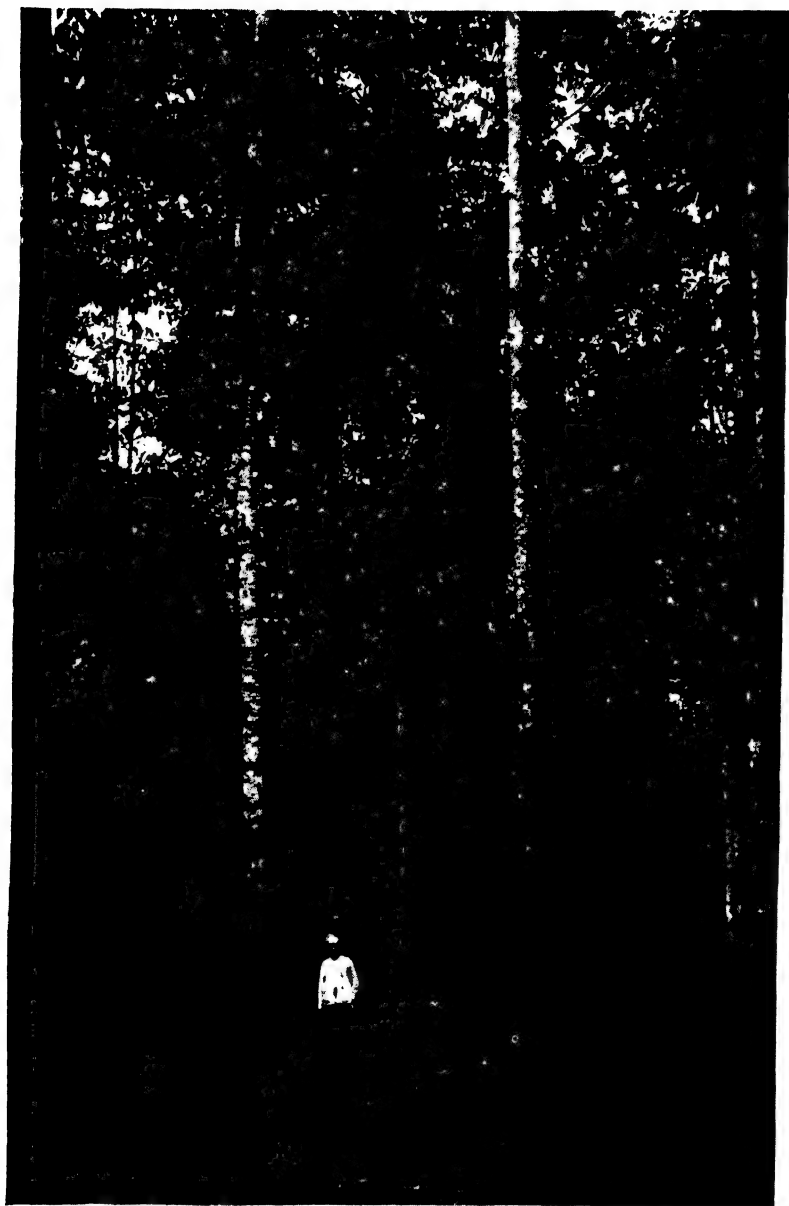
would be permitted by the Forest Officer with the object of obtaining young crops of teak. But it would be useless to go to the expense of raising young crops outside the Reserves which would be burnt in the first fire—since the expense of fire-tracing numberless small plots of teak would, of course, be prohibitive.

Brandis advised the addition of the very valuable Zamayee teak forest to the area included in the three districts above mentioned, which would bring the total area up to 1130 square miles. Prome and Thayetmyo, 350 ; Tharrawaddy, 580 ; Zomaye, 200 square miles. "This area," he said, "comprises the best teak forests in British Burma, and a large extent besides of excellent forest of bamboo and trees of other kinds, which, in course of time, will become very valuable. But it also comprises a large extent of forest which is probably valueless, and which never can be valuable for any purpose whatsoever. The good forest worth preserving does not probably comprise more than 600 square miles. . . . Even with this area reserved and properly conserved it would only be capable, for many years to come, of furnishing a small portion of the present timber exports from Rangoon and Moulmein."

Some interesting information anent the Karen population of this area is available. In the Tharrawaddy Forest Division there were reported to be 40 *tays* (Karen hamlets), estimated to contain about 400 *dahs* or *taungya*-cutters, who were supposed to cut on an average 5 acres annually ; the Zamayee, 10 *tays* with 64 *dahs*, giving a total annual cut of 2320 acres. In the Prome hills the estimated number of *tays* was 50, cutting, on an average, an area of 2500 acres annually. The area cut annually was therefore under 5000 acres, required to maintain a total population of 5000 souls, including women and children. Allowing for a rotation in cutting of 20 years, the maintenance of this population by *taungya* cutting would require an area of 100,000 acres or 156 square miles ; or, to allow for steep slopes, poor ground, etc., an area of 300 square miles, and it was well known that even with such an area assigned to them, they would not be likely to keep within it. The task set to the Demarcation Officers was therefore, Brandis fully recognized, a difficult one. To select and demarcate 600 square miles of the best teak forests, if such an area was obtainable, to arrange for the total exclusion of *taungya* cutting within these Reserves, whilst keeping the Karens happy and ensuring their co-operation in guarding and helping to work the Reserves.



A GROUP OF OLD TEAK IN A GROWTH OF *BALIBUSI POLYMORPHA*, PRIME DIVISION, BURMA
A. Rodger, photo.



A FINE GROUP OF KANYIN (*DIPTEROCARPUS TURBINATUS*) POLES. PHOTO.
TAKEN JUNE 1922 NEAR PINWE ON WEST OF RAILWAY LINE. BURMA

Photo. by H. R. Blanford

In 1868 a report had been drawn up on the question of selecting teak Reserves, in which conditions as to accessibility, nearness to floating streams, extent, tendency to form irregular stems and so forth, had been laid down. But little of this demarcation of Reserves had been accomplished in the interval, and, as Brandis remarked, "since 1868, eight years of incessant *taungya* cutting have elapsed, and the area of good forest now available for demarcation is much less than it was at that time. Within the limits to which the present remarks relate, therefore, we must demarcate good forest whenever we can obtain it in compact blocks of sufficient size to make its protection and management possible, leaving in every forest district, but outside the Reserves, areas amply sufficient for the requirements of the Karens."

It may be suggested that Brandis' proposals, as here adumbrated, might be well worthy of the consideration of Officers in the Forest Services under the Colonial Office, many of whom are faced with the problems of shifting cultivation and the rapid disappearance of valuable forests which this practice inevitably brings in its train.

The Inspector-General then considered in detail the procedure to be followed by the Forest Settlement Officers in the work of demarcation, a procedure which is now well known and therefore need not be gone into here. He advised, however, that the Forest Officers, whilst engaged on the selection work, should record preliminary proposals regarding the girdling operations to be conducted in the selected Reserves. This would be a help to the future Divisional Officer. They might even in some cases undertake girdling operations in more inaccessible areas. Pending the selection of the Reserves, it may be mentioned that girdling had been stopped under orders of the Government.

The Demarcation Officers were to lay out the boundaries of the Reserves so as to leave sufficient forest outside from which the agricultural population of the vicinity could obtain their *bona fide* requirements in wood, bamboos, grass and grazing, etc. When this was not possible it would be necessary to allocate blocks of forest for the local villages and give them certain definite privileges to materials within them. But no occupiers of agricultural land taken up after the creation of the Reserves could participate in these privileges. All existing rights would be enquired into on the spot by the Demarcating Officers, and eighteen months would be allowed for appeals

from their decisions. After the lapse of this period a special Commission should go round the boundaries, with powers to enquire into the appeals and settle them once for all.

The question of the District Forests now requires consideration. After the conquest of Pegu, by notification of the 26th September, 1853, all forests in the Province were declared the property of the Government, and teak was at the same time declared a reserved tree (*vide* Vol. I, p. 244). Government had therefore the indisputable right to all unalienated forest and waste lands as the successors to former Governments who held this right. Under this right, and under Rule XII of the Rules of 1865, by notification of 2nd June, 1873, *thitkado* and *thitka* trees, and by notification of 1st January, 1876, *thingan*, *thitvee*, *kodoh*, *pyinkado*, *padouk*, *anan* (*Fagraea fragrans*), *engyin*, *thitya*, *eng*, *pymmah*, *kanyin* (*Dipterocarpus turbinatus*), and *sha* (*Acacia Catechu*) had been declared reserved trees. The definition of District Forests would be simple; the forests demarcated as Reserves would be State Forests, and those not included in Reserves would be District Forests. Brandis, however, anticipated that a third class of forest might eventually be demarcated, in Burma, in the following words:

"In the open and forestless parts of the country, such as portions of the Irrawaddy valley and delta, an attempt will be made to preserve scrub and jungle on high ground or elsewhere where the land is not fit for paddy (rice). In such localities the formation of village forests would probably be a popular move among the agricultural population. These woodlands would be demarcated and sufficiently protected. No *taungya* or other cultivation should be permitted within them, but they should be maintained to furnish fuel and grazing, shade and shelter to the village cattle.

"Government should retain full proprietary rights over these woodlands, and should, in the interests of the people, control their management, but otherwise they would be in the position of communal forests, their produce would be shared by the villagers, and they would be free to them for pasture as far as would be compatible with their proper maintenance."

Here we have the dream of every keen and thoughtful Forest Officer put into a nutshell, the control being by the Forest Officer and based on a Working Plan, as in Europe.

The suggestions for the management of the District Forests may be briefly epitomized as follows:

They were to be in charge of the Civil Officers, assisted by the Forest Officers. No demarcation of these areas had yet been undertaken in any district, so no general proposals for their management could be laid down. Brandis suggested (1) There would be no interference with *taungya* cutting, save that teak must not be touched without permission. (2) Local agricultural population to obtain their *bona fide* requirements, including the reserved trees (except teak) free from the forests. This permission to be also granted to old residents living near the outer line. (3) For trade purposes two classes of permits to be issued : first, for minor products to be issued by the District Officer, the counterfoils to go to the Forest Office ; second, for timber of certain reserved kinds, the payment would be a fee before the tree was felled, and a royalty on the material when it passed the Forest Revenue station. Only *eng, pymmah, engyin, thitya, thingan, kodoh* and *pyinkado* could be so sold, the other reserved species, being more valuable, to be worked out departmentally as required. (4) Custody of teak throughout the Province should remain under the Forest Department ; since its strict protection had come into force the beneficial results had been surprising. (5) Receipts and expenditure on account of the District Forests to appear in the accounts of the Forest Department.

Brandis commented on certain articles of minor produce which were becoming scarce, instancing the leaves of *mhayaben* (*Cordelia* sp.), which furnish the best covering leaf of Burmese cheroots. Owing to the wasteful methods of collecting, these trees were now scarce in forests (Magayee and Hline) from which in former years large quantities were sent to Rangoon.

In the last section of this admirable Report Brandis turns to the question of the organization of the Staff and its work.

In his 1873 Report Baden-Powell had recommended an increase in the subordinate establishment. This had been effected and the staff now consisted of 18 Rangers, 17 Head Foresters, 20 Junior Foresters and 24 Forest Guards, the rates of pay having been increased throughout on the incremental basis. At this period the staff was stationed on the *streams*, each stream being in charge of a Junior Forester or Forest Guard, whilst the Rangers and Head Foresters were in charge of groups of streams. This, of course, followed the old precedent in the manner in which the timber contractors and licensees worked, as they had no care for the improvement of the forests. In future, however, as soon as the demarcation was completed in any Division, the staff would be redistributed to the Reserves (have charge of blocks of forest) and no longer be confined to looking after the extraction work on the streams.

In the controlling staff the important departure made was to appoint separate Demarcation Officers. This staff was not yet complete, but, as has been shown, it was to be concentrated on the area above described and not frittered all over the Province. Brandis strongly advised that this staff should be maintained until all the demarcation work was completed. The proposed strength was 2 Deputy Conservators and 3 Assistant Conservators. As regards the Province as a whole, the Forest Divisions which should be formed or maintained were as follows : (1) Timber Depot, Agency Office and Rangoon Division, 1 Deputy, 1 Assistant Conservator ; (2) Drift and sea-shore timber, river police and drift-timber stations on Irrawaddy and Hline Rivers, 1 Assistant Conservator (this Division was formed for the better control of drift-timber and to work out more vigorously the large quantities of timber drifted out to sea, some of it years ago, and lying stranded and half buried in the mud of the Sittang River). (3) Tharrawaddy Division, 1 Deputy, 1 Assistant. (4) Prome, 1 Deputy. (5) Western Division, north, 1 Deputy. (6) Western Division, south, 1 Assistant. (7) Sittang, 1 Deputy, 1 Assistant. (8) Salween Division, including Kado Depot, 1 Deputy, 1 Assistant Conservator. In addition, at least 2 Supernumerary Sub-Assistant Conservators would be required. Brandis considered that this was the minimum staff necessary for Burma at this period, and to maintain it at its full strength a regular recruitment of junior trained assistants at one per year should be maintained. "Language, climate and vegetation," said Brandis, "separate the forest service of Burma from that of the other Provinces under the Government of India, and the Forest Department in this Province will probably more and more become a local service." He also pointed to the disparity in pay in the controlling ranks between the Forest and the Police, whose emoluments were much higher although they did not receive a specialized training before joining the service.

Although strongly advocating commencing the demarcation work in the area above alluded to, it is apparent that Brandis would have himself preferred to start demarcating Reserves in the Attaran Forests and commencing plantations on a large scale there, "but it would probably be necessary to defer this, like many other useful projects, for the present."

The average annual revenue for the six years 1856-7 to 1861-2 (Brandis' regime) was Rs.2,77,352, and for the seven

years 1868-9 to 1874-5 was Rs.9,08,908. The average annual cash surplus for the same periods rose from Rs.30,357 to Rs.4,66,621. Nearly the whole of the revenue was from teak timber. The question to be solved was whether the growing stock of teak in the forests under the control of the Department was equal to furnishing a continuous annual yield of 45,000 tons. That point could only be determined by a systematic examination of the growing stock, and this work could not be commenced until the staff had been increased to the cadre above mentioned.

In 1880 Brandis paid another visit (his last) to Burma and spent the first four months of the year there. At this period Mr. B. Ribbentrop was Conservator of the Pegu Circle, and Major Seaton Conservator of the Tenasserim Circle. The Report written by Brandis on this visit, entitled "Suggestions Regarding Forest Administration in British Burma" (dated Calcutta, 20th January, 1881), is a volume in itself. It forms a concise history of the progress made in Forest Conservancy since he first landed in Burma in 1856, and introduced the true principles of forest administration, which he was subsequently to be the means of spreading throughout the Indian Empire. Through its pages it is possible to trace the steps, both retrograde and progressive, which had placed Burma in the position she had now attained. And in imagination one can visualize and sense the pride of the man who, on the threshold of retirement, was able to compile such a Report as this and speak with the authority which rings through it. It is more than probable that, for many parts of our more backward Empire Forests, a perusal of this Report would be as valuable to-day as at the time it was penned. It may be added that the Report only relates to the Pegu and Tenasserim Forests. No regular forest administration had yet been introduced into Arakan; and Upper Burma had not yet been annexed. It is unfortunately impossible to do more than deal briefly with its main points.

The demand for teak timber, as Brandis had forecasted, showed no signs of diminishing. For the eight years 1856-7 to 1863-4 the total mean annual imports had been 85,056 tons (of 50 cubic feet), the mean annual exports 76,763 tons, and mean annual local consumption 8293 tons; for the five years 1869-70 to 1873-4 the figures respectively were 133,204, 98,095 and 35,109 tons; and for the years 1874-5 to 1878-9 respectively 227,149, 134,563 and 92,586 tons. The quantities imported approximately represent the

total amount consumed in Burma, India, Europe and other countries during these periods. Hence the total annual consumption of teak timber had gradually risen from 85,000 tons to 227,149 tons. Of the exports for the five years 1874-5 to 1878-9, an amount of 85,635 tons went to Indian ports and 48,928 tons beyond India. The largest increase had taken place in local consumption, which had risen from 8293 during the first period, when extensive buildings were built at Rangoon after the second Burmese War, and 4864 during the period 1864-5 to 1868-9, to 92,586 during the last period. It was significant that the increased consumption had in no way been aided by diminished prices, teak timber at Rangoon and Moulmein commanding about the same price in 1880 as it fetched twenty years before. Brandis thought that there was every reason to anticipate that the annual consumption would continue to increase, and added "should it hereafter become possible to sell teak timber at the Burma ports at lower rates, or should freight diminish, a very large increase in the annual consumption may be anticipated." He then proceeded to discuss the prospects of future supplies, dealing especially with the supplies of foreign timber from Upper Burma. His remarks in this connection need not be followed here because he could not anticipate the near approach of the third Burmese War which was to completely alter the position of these forests and their future method of management.

When the first Working Plan was framed to regulate the yield of the forests in Pegu and Tenasserim for the twelve years from 1856 to 1867 the area of teak-producing forests was estimated at 2397 square miles. In 1880 it was not considered that this estimate required material alteration—a wonderful tribute to Brandis' work. It was estimated (based on valuation surveys) that this area had contained 1,855,000 mature teak trees of 6 feet in girth in 1856. From data available in 1856 it was calculated that teak trees in these forests would attain 6 feet girth in sixty-two years, and the maximum number of trees to be girdled annually was fixed at 27,000. The 1868 plan of working for the succeeding five years excluded the Western and Upper Salween Forests, which were leased out with permission to girdle, and the Pandaw and Attaran Forests, which were in the hands of private parties, 416 square miles in all. On the remaining 1981 square miles it was estimated that there were 934,000 mature trees in 1868. From data collected in this year the rate of growth was considered to be much slower than Brandis' figure, and it was put at 160 years to attain 6-foot girth; the number of trees to be girdled annually being fixed at 11,600. From the data available in 1880, Brandis considered that whilst his earlier estimates were too favourable those of 1868 were too unfavourable both as regards rate of growth and the amount of growing stock.

As regards the question of teak production the main points requiring consideration were—what steps had been taken and what steps should be taken to ensure the demarcation of a sufficient area of teak forest to be permanently maintained. And, as demarcation work took time, what measures should be devised to continue the existing system of protecting teak throughout the country.

With reference to species other than teak, it has been already stated that a certain number had been reserved under the Rules, for which payment had to be made if taken out for trade purposes. This measure had proved beneficial to the extent that timbers not included in the list had been extracted in preference to those included. Brandis now considered, however, that the maintenance of so large a number of reserved trees and the system generally was cumbersome and might with advantage be simplified. Free permits had been issued too liberally, several hundred logs having on occasions been given away on a single application, entailing abuse and waste. On the other hand, the necessity of taking out free permits for timber required for home consumption led, and had led, to extortion and speculation. He now proposed that free permits should be dispensed with altogether, and that all timber and other forest produce which was extracted for the purposes of trade should be taxed. There would be no interference with trees cut for clearing ground for cultivation or with people living within five miles of the forest obtaining therefrom produce for their own local requirements, with the exception of teak and such other species as might require protection in specified localities. Revenue from minor produce would continue to be levied as before with the exception of cutch, which should pay Rs.20 per cauldron for the season.

Cutch.—The position of the cutch (*Acacia Catechu*) extraction business is worthy of mention. In Burma the tree is found in the drier parts of the Province and had been very abundant. The heart-wood lasts better than teak and therefore many thousands of young trees were usually cut for house-posts. But the chief product of the tree is cutch or catechu from mature trees. From December to March large settlements of people from beyond the frontier and from British Burma were in the habit of establishing themselves in tracts where mature trees existed and near water. All trees with a sufficiency of heart-wood were cut down and dragged to the settlement. The heart-wood was then cut into chips, boiled with water, the solution then being boiled down and the extract cut into flat shining nearly black cakes, which form the cutch of commerce.

This procedure still obtained at the close of the century. Until 1876 cutch boiling was carried out everywhere in British Burma without any tax or restraint except in the few existing Reserves. A tax of Rs.5 per cauldron was then instituted. It was subsequently raised to Rs.10 in Tharrawaddy. Brandis proposed doubling it for the following reasons: One cauldron in full work for four months required eighty trees. The Government revenue at Rs.10 a cauldron came to 2 annas per tree only. In 1873 cutch sold at Rangoon at Rs.20 per 100 viss (365 lbs.); in 1879 the rate rose to Rs.36 per 100 viss, and there was no prospect of its dropping. Between 1876-7 and 1878-9 the Government revenue amounted to Rs.48,171, representing about 750,000 trees cut down in the upper part of the Irrawaddy Valley. The result of this wholesale destruction was that, save in remote villages, large trees fit to yield cutch had almost disappeared from the Tharrawaddy, Prome, and Thayetmyo Districts outside the Reserves. The Toungnyo Valley in Tharrawaddy had formerly been one of the chief habitats of this tree. Cutch was an important article of the world's trade. In 1879-80 the export of this article from Burma (the chief supplier), Bengal (probably Burman, re-exported), Bombay and Madras amounted to 11,106 tons (of 20 cwts.), valued at Rs.28,13,994, of which only about Rs.1400 worth came from Bombay and Madras.

Brandis did not advocate the retention of the list of fourteen reserved trees (besides teak). He suggested that only thingan and padauk should be reserved in addition to teak, power being given locally to reserve any species suffering from overfelling.

The demarcation work proposed in the Brandis Memorandum of 1876 had been carried out with vigour, and by 1880 it is apparent that 1652 square miles of Reserves had been demarcated and sanctioned in the Pegu Circle, of which 1180 square miles were in the districts of Thayetmyo, Prome, Tharrawaddy and Hanthawaddy. In addition, 388 square miles had been demarcated and sanctioned in the Tenasserim Circle in the Salween and Amherst Districts, making a total of 2040 square miles. Another 1179 square miles had been proposed for reservation in the Pegu Circle, and 643 in the Tenasserim Circle. Brandis' queries as regards the above programme were: (1) whether the above area was sufficient to meet the objects in view and (2) whether the full demarcation of the above area would not tend to impede the extension of cultivation.

The Inspector-General gave detailed reasons for his answers to the above questions. In the first place he pointed out that

the whole of the above area did not contain teak, probably not more than 2000 square miles of it. He quoted figures to show that with proper conservative management this area should in the future, under scientific treatment, be able to provide for a proportion of the market requirements. His second query he answered in the negative, one of his arguments being that the culturable area included in the Reserves would be very small.

The suggestion he had previously made with reference to the Karens and the demarcation question had not been followed. Seaton's idea of demarcating fixed areas, within whose limit the Karens should be at liberty to cut their *taungyas*, had been adopted and followed in the demarcation work of all the Reserves on the western slopes of the Pegu Yoma in the Tharrawaddy and Prome districts. All sorts of absurd objections were advanced against this settlement of the matter, one, that the areas assigned were too small. Since the total area of Reserves between the Nawing and Thoonzai Forests was 807 square miles and the tract assigned to the Karens amounted to 213 square miles, this argument was fallacious. Brandis advised that the Karen areas should be regarded as separate blocks in the Reserves, the treatment of which could not yet be settled. Mature teak should, however, be girdled on the same principles as adopted in the Reserves.

The steady rise in the forest revenue formed Brandis' best asset in pressing his remarks. For the first three years after he commenced work in Pegu, 1856-7 to 1858-9, there was a small deficit. The mean annual surplus between 1859-60 and 1878-9 had risen from Rs.1,51,744 to Rs.6,17,845. The Inspector-General pointed out, however, that for some years to come heavy outlay would have to be incurred on demarcation work, planting and other operations of improvement, and that therefore the expenses must of necessity increase largely. Moreover, many of the Reserves which were being taken over had been impoverished by reckless fellings and would yield little or nothing for years to come.

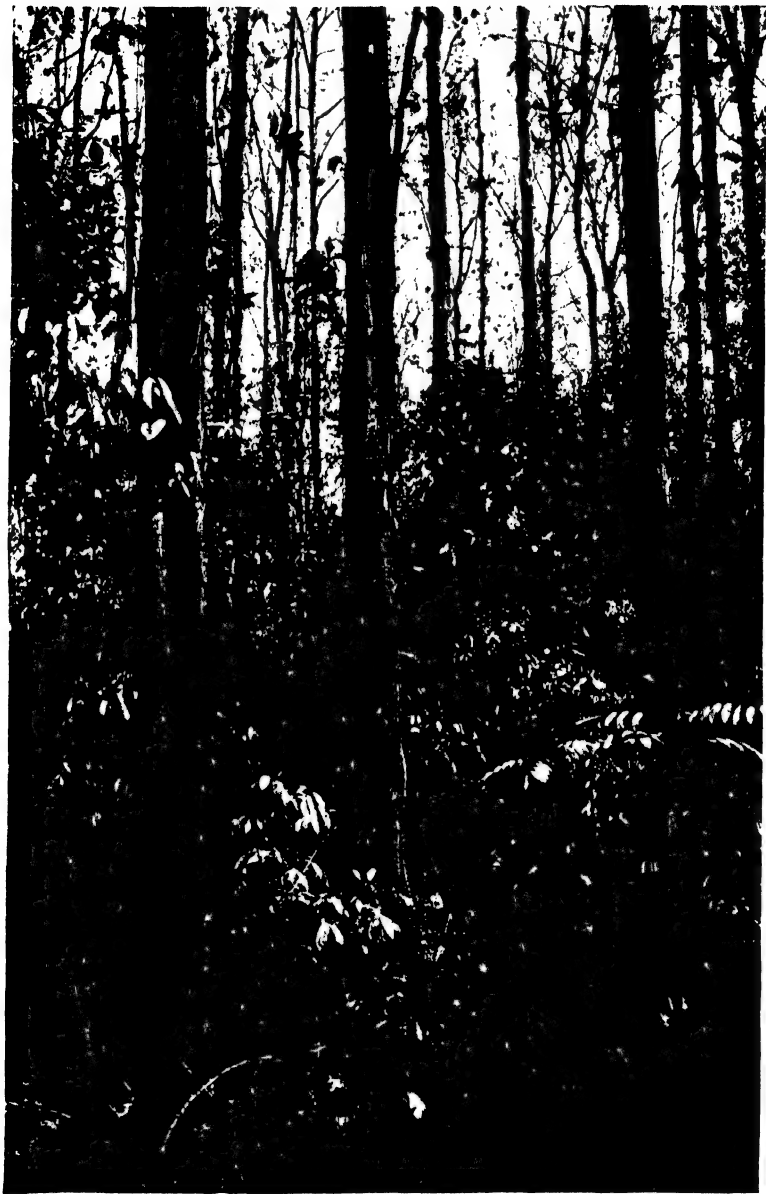
Under measures of protection and improvement Brandis considers in some detail the methods by which the proportion of teak in the forests could be increased. The aim was not to form pure teak forests, since the tree thrives best in associated mixtures of bamboos or other trees. He did not think the proposed area of 3474 square miles of teak forests would ever be capable of producing the entire quantity of teak required

by the Province and for export. It might prove necessary to demarcate additional areas, and other permanent sources of teak might become available; but, in any event, it was necessary to increase considerably the proportion of teak in the forests which would be under the charge of the Department. After discussing the necessity of having clearly marked boundary lines round all the Reserves and interior ones round the Karen areas, he comes to the question of fire protection, which he regarded as a specially difficult task in the Burmese Teak Forests. He considered this protection essential and combined with other works of improvement, it would add large quantities to the annual yield of the forests. As yet, fire protection in the forests was in its infancy and required study. The area actually protected in Pegu during the hot weather of 1880 amounted to 54,000 acres at a cost of Rs.7500. Many of the areas thus protected were plantations rather than blocks of forest, and the outlay correspondingly heavy. In Tenasserim 42,200 acres were fire protected at a cost of Rs.1300.

In addition to fire protection, cultural operations were necessary. Teak would have to be sown and planted artificially on a very large scale if the forests were to contribute permanently a large portion of the teak supply of the Province. So far this work had been carried out on three lines: (1) regular plantations, (2) *taungya* plantations, (3) by sowing. The oldest regular plantations Brandis considers were those started in 1856 and 1857, though, as a matter of fact, older ones had been commenced though without great success in Tenasserim (Vol. I, 189, 241-2). The total area planted in Pegu and Tenasserim Circles to 31st March, 1880, was 3389 acres, at a cost of Rs.3,00,689, or at an average rate of Rs.88 per acre. He estimated that these plantations, when mature, should furnish an annual yield, excluding thinnings, of 3300 tons, and some would yield thinnings long before they reached maturity. Brandis proposed that 200 acres a year should be planted by sowing teak with crops of cotton, *til* seed and vegetables raised for sale (this had been the way in which many of the larger existing plantations had been raised), the sites for new plantations being carefully selected. As regards the second method, by *taungya*, a description of this and the results attained has been already given in Volume II, pages 568-70. The third method, by sowing, was initiated by Ribbentrop. He had tried two methods: (a) cut and burnt bands in bamboo forest 100 feet wide, over a total of



TEAK FOREST, 150-300 YEARS OLD. TAUKTAKUGYI RESERVE, RUBY MINES DIVISION, BURMA
A. Reiger, photo.



MYODWIN TEAK PLANTATION, ZIGON DIVISION, BURMA. AGE ABOUT 40 YEARS
Research Institute, photo.

141 acres in Mokka Beeling, Nyanlay and Bwet. The results were very successful. The bands were commenced by Mr. Wild in the Mokka Beeling Forest. If the cost could be reduced Brandis thought the method would be a very good one, (b) Dibbling in seed when the bamboo had flowered, or in forest without bamboo under girdled trees. This operation had been commenced by Ribbentrop in 1876. About 950 acres had been treated under *myinwa* (*Dendrocalamus strictus*) and *tinwa* (*Cephalostachyum pergracile*) bamboos after flowering in Choungzouk, Bwet, Nyanlay and Mokka Beeling; and 635 acres under girdled trees in Kangyee and Mokka Beeling (10 acres only in last named). This plan Brandis considered excellent, since it was cheap (Rs.5 per acre); but he pointed out that efficient control over a large number of small plots would not be easy; and it is known that subsequently many of them were lost sight of and not thinned at the proper time. Many thousand acres could, he pointed out, be converted into rich teak forests. For the present he suggested that Rs.6000 per annum might be devoted to this work. As regards climbers, he alluded to the freeing of teak from these pests, to which Falconer drew attention in his Report (Vol. I, p. 232) and suggested felling badly infested trees. Brandis noted that this work was being carried out along existing paths. Later on it should be undertaken in the interior of the blocks of forest.

With reference to future girdling, which operation had been restarted, he considers the question in all its aspects. Briefly his recommendations were that valuation surveys were to be the basis of girdling operations; that the work could be restarted in the demarcated Reserves on the findings of valuation surveys; that it should be undertaken with great caution in districts where demarcation had not been completed; and, lastly, that in all areas finally excluded from the demarcated Reserves all teak which had reached a marketable size could be girdled as required. The main out-turn would come during the succeeding five years from the Pegu Circle as it would only be possible to girdle sparingly in the Tenasserim Circle. In order to obtain accurate statistics regarding the rate of growth of teak, Brandis advocated the marking out of sample plots of which records could be kept.

An interesting survey is given in the Report of the great amount of work which had been undertaken in blasting rocks to open out streams, by which means forests previously

inaccessible, and which had consequently escaped the destructive energies of contractors, had now become exploitable. To demonstrate the importance of this work, Brandis states that "of the whole out-turn of timber which the Tharrawaddy Forests have furnished during the last twenty-three years, and which amounts to 198,000 tons, two-thirds could not have been extracted, had the streams not been opened by blasting and otherwise." Of course the importance of this class of work is well known. The Governments of Sweden, Austria-Hungary and Rumania in the latter half of last century raised considerable credits which were devoted to these purposes, with the result that they captured the European timber markets, Sweden the British, and the other two countries the markets of the Mediterranean.

Under the organization of the Department, Brandis recapitulates the work before the Burma Forest Officers, and it was sufficiently arduous : (1) selection of Reserves, settlement of rights, demarcation ; (2) protective work ; (3) planting and other measures of improvement ; (4) girdling operations and systematic examination of Reserved Forests ; (5) opening of streams for floating, etc. ; (6) working of the forests on Government account ; (7) collection of revenue from forest produce exported for trade from forests outside the Reserves.

The Controlling Staff already mentioned earlier in this chapter had been slightly increased, but it was quite inadequate for the work. Brandis suggested that a commencement should be made to train a number of young Karens and Burmans as apprentices for appointment subsequently as Forest Rangers. The Government of India said there need be no limit to the number of such apprentices entertained as the Chief Commissioner had the power to appoint any additional temporary establishment required. If the men turned out well they would be appointed as Forest Rangers and could rise to Sub-Assistant Conservators. The work before the Department could only be accomplished, in Brandis' view, by a considerable increase in this cadre, since there appeared small hope that the Controlling Staff would be increased. In this policy the Inspector-General was only advocating a measure he had prescribed elsewhere in India. His hope for years had been and still was that a sufficiently good stamp of man would come forward. The hope had not been realized by the end of his service, nor was it realized to any extent by the end of the century. And throughout the period the Controlling Staff was kept far below

the requisite strength to cope with the work demanded of it. That this was the case Brandis' enumeration of the Controlling Staff in Burma in 1880, of 2 Conservators, 7 Deputy Conservators, 7 Assistant Conservators and 4 Sub-Assistant Conservators, shows. The deficiency (twenty-three officers excluding the Conservators were required), he remarks, could most economically be filled by increasing the number of Sub-Assistants, but even if the appointments were made they could not be filled as there were no Forest Rangers in Burma qualified to fill them. The operations, therefore, he admits, would have to be contracted until the staff was at full strength, and the growth of the revenue and the improvement of the forests would be much influenced thereby.

As an indication of the great progress made in Forest Administration in Burma within a score of years of the time at which Brandis took up his appointment as Superintendent of Forests in the Province, the Working Plan prepared for the Thonzé Forests, situated on the borders of the Yoma in Pegu, may be briefly alluded to.

This plan was drawn up in 1883-4 by Mr. J. W. Oliver, Deputy Conservator of Forests, assisted by Mr. H. Slade. The forest for which it was prepared was the Thonzé Reserve of 69,734 acres, which included an area of 9413 acres made over to the Karens for *taungya* cultivation at the time of the Settlement. The field work undertaken consisted of (a) the division of the forest into blocks and compartments, (b) the valuation of the forest in each compartment, (c) the calculation of the rate of growth of teak trees of different classes. The work in the forest was interrupted by the sickness of the staff, due to the malarious nature of the forests and the necessity of constantly having to recruit fresh men and teach them the work connected with the enumeration of the growing stock, and so forth. The cost of this part of the work, amounting to Rs.15,482, was consequently higher than it would have otherwise been. The objects of management were described as follows: "to utilize to the best advantage the existing growing stock of teak timber, and at the same time increase the percentage of that species in the Reserve." Oliver added the remark: "In view of the almost certain falling off in quality and eventually in quantity of teak timber from foreign countries, both the interests of the State and the requirements of the consumer demand the production chiefly of dimensions suitable for the European and Indian markets (6 to 7 feet girth), and in a less degree of trees of smaller size for provincial requirements."

There are several points connected with this plan which render it noteworthy for the period as marking a long stride in a forward

progress by the Burma Department. It was drawn up by a trained officer who was to achieve distinction both in Burma and subsequently as Director of the Forest School at Dehra Dun. Oliver in Burma showed high professional attainments and at the same time was no mean botanist. We find evidence of both in this Working Plan. It is not a mere plan of operations for a short period of years, which was in reality the character of the plans which had been and were being drawn up in India to ensure a commencement of an organized method in fellings, and so forth, in different forests in the country. The Thonzé Working Plan was drawn up on the lines of scientific Working Plans in Europe, and sufficient data on the rates of growth of teak, and other matters, were now available to enable the Working Plan's Officer to give full play to the technical training he had received in Europe. The rotation of teak was fixed at 150 years, the area being divided into five periodic blocks of thirty years each. The plan was framed for one complete rotation, but the annual yield and area to be girdled over (the marking and girdling of the trees being done, it will be remembered, by the Department) was fixed for the first period of thirty years only, 1885 to 1914. The Thonzé Forest occupies a succession of hill ranges (the highest elevation, 2261 feet), running mainly north and south, with intersecting streams and much broken ground being bounded by the Kon Bilin, Kadin Bilin, Kadat and Okkan Reserves. It was constituted a Reserve on 2nd May, 1878. It consists of various types of forest : (1) evergreen forest, (2) moist forest, (3) dry forest, (4) *indaing* (*Dipterocarpus tuberculatus*) forest. The marketable products from this area at the time were teak timber, *pyinma* and *kanvin* timbers, timber for boat-hulls, cutch, bamboos, shaw fibre and *kanyin* oil. The forest is accessible to the Hlaing or Rangoon River and was doubtless exploited in Burmese times, but no record of the amount of timber taken out before the advent of British rule was extant. The number of trees girdled between 1854 and 1884 was 25,426.

It is impossible, nor at the present day is it necessary, to go into the details of this interesting plan. The careful description of compartments, the selection of sample plots and detailed measurement of the growing stock in each, and so forth, enabled the framer to fix his yield at a thousand first class trees to be girdled per annum, the proportion of younger-age classes present being considered satisfactory. It will be remembered that Brandis' first enumerations of the growing stock in the Burmese Teak Forests had been by means of the linear surveys method. Oliver's remarks on this head are of considerable interest, as they must have been invaluable at the period : " Compared with previous surveys in the Thonzé Forest, the average number of teak trees per 100 acres teak-producing forest stands as follows :

Area and Date of Survey.	Trees 6 ft. girth and above.	Trees 4½ to 6 ft. girth.	Trees below 4½ ft. girth.
Per 100 acres.			
Linear surveys made in 1858 and in 1863 extending over 1817 acres	117	105	392
Linear surveys made in 1868-9 extending over 1268 acres .	105	134	1907
Sample plot countings of 1883-4 extending over 5804 acres	37	88	843

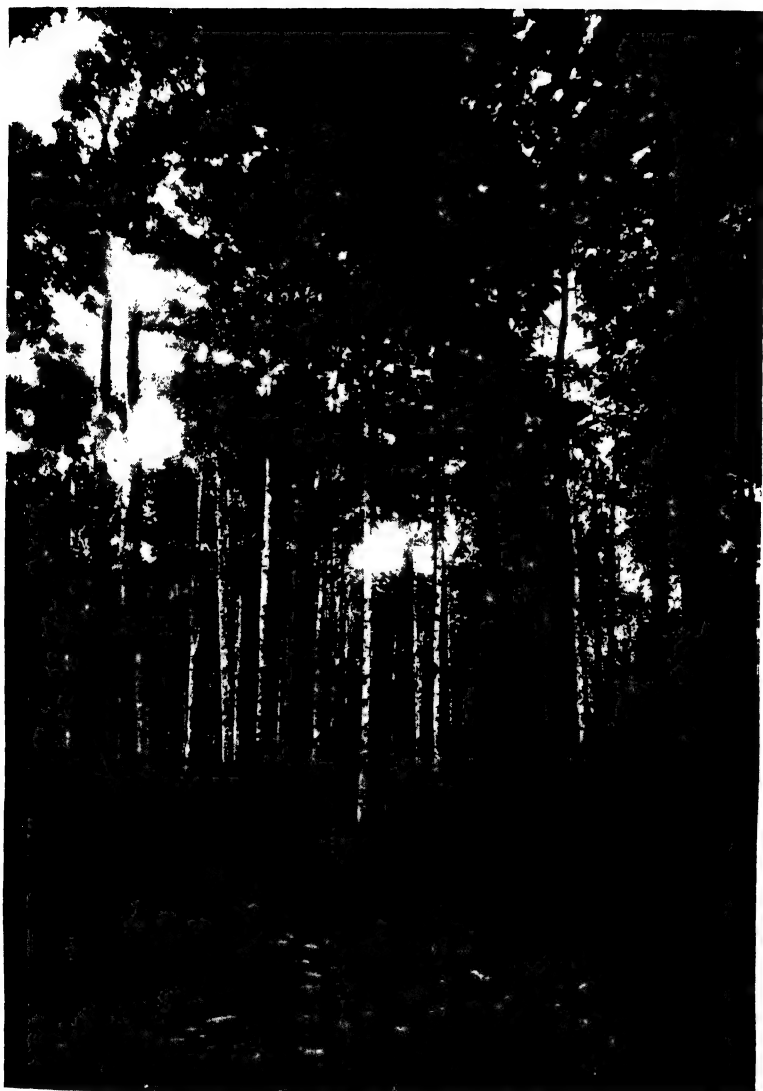
The linear survey appears to have been generally carried along the crests of ridges, where teak is always more abundant than in the valleys, and valuation surveys conducted on this principle would naturally give higher results than surveys which include a like proportion of hill and valley. The very small number of trees below 4½ feet girth found on the earlier surveys is remarkable. This point was noticed in the Government of India Resolution on the Annual Report of 1868-9, and the increase in small trees attributed to improvement of the forest and partly to the surveys not having been carried over a sufficiently large area of the forest to give a true average."

One of the most important events in the forest history of the period was the annexation of Upper Burma in January, 1885. In the *Annual Review of Forest Administration*, by the Inspector-General, for 1887-8, the first result of this new acquisition is apparent in the division of Burma into Lower and Upper, and the inclusion under the latter of an estimated area of 5153 square miles of protected forests. Linear valuation surveys had already been carried out over some 2000 acres in the Chindwin, Mandalay, Mu and Pyinmana Divisions, in order to obtain roughly the proportion of living teak of different ages to girdled and dead teak. These data would enable an estimate to be made as to whether the possibility of a forest had been, or was being, exceeded. The organization of the Department, especially of subordinates, was very much retarded by the paucity of gazetted officers in Burma to man the suddenly greatly expanded forest areas of the enlarged Province. Close European supervision was essential when the appointment of a considerable number of new subordinates was in question. Hill, officiating Inspector-General at the time, wrote: "The Provisional Permanent Staff, in so far as

Forest and Depot Establishment go, is purely tentative. It will have to be doubled, at least, as the forests are brought within touch and their stricter protection as Reserves has to be arranged for." It was early recognized that these forests in Upper Burma were both extensive and valuable, and had materially added to the forest wealth of the State. A determined effort had been made by timber merchants to carry on the old lumbering methods of exploitation. In the Inspector-General's (Ribbentrop) *Review of Forest Administration*, 1888-9, page 4, the following appears: "After a long controversy, agreements were concluded with the Bombay-Burma Trading Corporation for the working of the forests in Upper Burma, which they held under licences granted by the late Burmese Government and settlements with other licencees were in course of completion." The *ad valorem* duty on timber brought to Moulmein from Karenni and the Shan States was from the 1st April, 1889, raised to the rate of 7 per cent, which had been in force prior to 1881. This was rendered the more necessary as most of the forests had become the property of the British Government in consequence of the arrangements made with the Shan States subject to Upper Burma. During 1888-9, when the newly introduced organization had been working a bare two years, the forests yielded a gross revenue of nearly sixteen lakhs of rupees, and this sum was speedily exceeded. Hill was the officer especially associated with this work. By 1889 a new staff comprising twenty-one officers had been sanctioned for the new forest areas. As has been shown, a Special Forest Law was enacted for Upper Burma (II. 474).

In the *Quinquennial Summary of Forest Progress*, 1884-9, Hill, writing on artificial reproduction work in Burma, said: "Special attention has been given to the system of teak *taungya* plantations in Burma and to cultural operations as aiding natural reproduction. At the close of 1889 regular plantations covered 55,371 acres, *taungya* plantations (chiefly teak), 16,119 acres; and cultural operations of different kinds had been successfully practised over 237,664 acres. For the restocking of the vast areas of Indian Forests, natural reproduction from seed or coppice shoots must, as has been often pointed out, be the mainstay; and the records of the marked improvement of the young growth in areas that are continuously protected from fire and grazing are a gratifying feature in the more recent Administration Reports."

By 1889-90 the exploration of the forests in Upper Burma



AN 1880 TEAK PLANTATION WITH *DIPTEROCARPUS ALATUS*, MAGAYI RESERVE,
INSEIN DIVISION, BURMA

Photo. May 20, 1923, by H. R. Blanford

was greatly facilitated by the more settled state of the country. The staff of the Department was nearly at the sanctioned strength, and the Government of India considered that it should be possible to spare one or more officers for the exploration of the forests on the drainage system of the Salween River. It will be recognized that the annexation had thrown an enormous amount of additional work on the Burma Forest Staff since from the area of forests provisionally gazetted as "protected" the Reserves of the future had to be selected, demarcated and settled. By 1890-1 an area of 16,000 square miles of forest had been examined since the annexation, with a view to selection of Reserves; this exploration had clearly indicated the wasteful manner in which the forests had been worked previous to the conquest, and had strengthened Ribbentrop's arguments in tendering the advice that no leases for exploitation should be given out without the guarantee of previous selection and girdling of the trees by the Department. Upper Burma had at first been formed into one Forest Circle with a Conservator in charge. In 1892-3 it became necessary to divide the charge, and two Circles were formed, the Eastern and Western, with headquarters in each case at Mandalay. Reservation work had got well into its stride, 1307 square miles having been reserved during the year. The total area of Reserves in the Province at the end of the year was 7407 square miles, with, in addition, 652 square miles of Karen areas. In 1895-6 the Reserves and *taungya* areas in Pegu and Tenasserim amounted to 7378 square miles, and in Upper Burma the area was 5439 square miles. At the close of the year 2128 square miles in Upper Burma and 1348 in Lower Burma were undergoing settlement, and other proposals were under consideration, so that, says the Government of India, "a large addition to the area of Reserved Forests, particularly in Burma, may shortly be expected." In order to elucidate the history of the progress of the Department it is necessary to realize that not only in Burma but in most of the other Provinces of India the same class of work was in progress—even in such advanced Provinces as the N.W.P. and Oudh. In this same year, e.g. in the Oudh Circle, the records of concessions were completed for Kheri and Bahraich, and were sanctioned by Government. In some cases such settlement work had been previously carried out, but so ineffectively that it had to be redone. In the majority it had never been attempted. Thus we find the staff still deeply engaged with

this essential work up to the end of the century. Although much remained, the bulk of this work had been completed by 1900, and the Forest Officer was free to devote his attention to his real professional duties, with results which will be described in the next part. In the last few years of the century Working Plans parties were busy at work.

The total area of forests under the Department in Burma was 89,417 square miles in 1899-1900, of which 17,154 square miles were Reserves (including 865 square miles of *taungya* areas) and 72,263 square miles of Unclassed State Forests, or 55·28 per cent of the total area of the Province. The estimated area of the unclassified forests of Burma was included in the Inspector-General's *Annual Review of Forest Administration* for 1899-1900 for the first time, "as these areas and their out-turn now find their place regularly in the returns of the Department." The provisions of Chapter IV of the Burma Forest Act and of the Upper Burma Forest Regulations applied to this type of forest. In 1900 an area of 2883 square miles was either under the provisions of Working Plans or plans were under preparation. A heavy task in this connection still remained to be undertaken by the Department.

The gross out-turn of the forests for 1899-1900 was as follows :

Agency.	Timber.	Fuel.	Bamboos.	Grass and Grazing.	Minor Produce.
	C. ft.	C. ft.	No.	Rs.	Rs.
Government	3,124,356	10,246	6,000	—	506
Purchasers	22,918,991	11,865,518	52,934,000	1,696	312,164
Free-grantees	376,073	1,000	2,000	6,735	—
Right holders	350,524	1,038,476	3,116,000	16,886	7,688
Total	26,769,944	12,915,240	56,058,000	25,317	320,358
Total for 1898-99	32,351,084	18,319,126	165,746,000	133,504	312,163

The Inspector-General's Review has the following remarks upon the above statement: "The reasons for the general falling off in the out-turn are not very clearly explained, but in the Pegu Circle departmental operations were hampered by the mortality amongst elephants due to an outbreak of anthrax, and in the Southern Circle the restricted operations of the Bombay-Burma Trading Corporation in the Pinyinana Forests account for a considerable decrease. The working of

the forests under leases, and based on Working Plans causes a considerable decrease in the output where forests have been over-exploited in the past, and in some districts the unclassified forests have been denuded of teak. The number of teak trees girdled was 29,270, of which 12,702 were in the Pegu Circle and 8406 in the Tenasserim Circle. The total out-turn of teak timber was 274,814 tons, of which 164,847 tons were extracted by lessees in the Northern and Southern Circles, including 60,022 tons from the Pyinmana Forests." There was an increase in the out-turn of cutch from the unclassified forests of the Pegu Circle (9116 tons), but a considerable decrease in the Southern Circle.

The revenue for the year (1899-1900) amounted to Rs.78,12,050, the preceding five years' annual average being Rs.66,15,542. The surplus was Rs.53,64,610, the preceding five years' annual average having been Rs.44,94,900. The proportion of surplus to gross revenue amounted to the large figure of 68·7 per cent. Progress in Burma was inevitably delayed by the short-sighted policy shown in devoting so small a fund to the amelioration of the forests, a first necessity of which was the maintenance of an adequate staff.

The Andamans Forests.

The working of the forests of the Andaman Islands was commenced in the early part of the period here considered. The exploitation was unregulated and no Working Plan was in force. The forests are of a tropical virgin character, in which progress was only possible by hewing out a path and the collecting of information on the growing stock proved difficult. The richest and most easily worked areas were heavily exploited for *padauk*, this being the saleable species. The supply, however, exceeded the demand, and the forest had suffered no harm. No steps had been taken to regenerate the areas exploited, the silviculture of the species being little understood. The Deputy Conservator in charge was directly under the Inspector-General of Forests, but periodical inspections were carried out by a Conservator from Burma. The material was sold either in log or converted form. The conversion was undertaken in the Chatham Sawmills, which belonged to the Settlement, and after various vicissitudes, were managed by the Forest Department. Towards the end of the century the foreign demand for *padauk* timber was rising.

CHAPTER IV

THE PROGRESS OF FOREST ADMINISTRATION IN THE CENTRAL PROVINCES AND BERAR, 1871-1900

THE introduction of Forest Protection and Administration in the Central Provinces commenced by Pearson and his able Assistant, Forsyth, was well carried on by Captain Doveton, who had succeeded Pearson as Conservator, when the latter was transferred to the North West Provinces (II, p. 305). During the period here under review, visits of inspection to the Provinces were made by three Inspectors-General—Brandis, Schlich and Ribbentrop—and their Reports give a clear insight into the lines upon which the administration was developed.

Brandis visited a portion of the forests in 1876 and again in 1877. The areas he inspected were the chief Reserves, as then constituted, in the Seoni, Balaghat, Mandla, Damoh and Jubbulpur Districts, the remaining Reserves being situated in the Districts of Chanda, Wardha, Betul, Nimar and Hoshangabad. He was accompanied throughout the tour by Mr. A. Smythies, an Assistant Conservator, whilst the Conservator was with him during the chief part of his visit.

The work of demarcating the Reserves was still proceeding, and it was contemplated that additional areas should be selected. The Reserves already demarcated were mostly situated in remote localities, at a considerable distance from the centres of consumption and from the existing main lines of communication ; and with the exception of the Banjar Forest they were said to be extremely poor in mature timber and other marketable produce. The table on p. 81 shows the areas of reserved and unreserved forest in the districts visited by Brandis as they stood in 1874-5.

It was evident that a great deal remained to be done to add to the area of the Reserved Forests. Moreover, Brandis pointed out that the unreserved forests could not be depended upon to furnish the country permanently with wood, bamboos, grass

and other forest produce. The so-called unreserved forests were merely the excess waste lands from which, at the time of the settlement, it was understood tracts would be taken up for cultivation; and, as a matter of fact, fields and villages had been established within their limits. Brandis showed that it was not contemplated, nor would it be possible, to improve the condition and growing stock in the unreserved forests which were entirely unprotected; and though an effort had been made, with some success, in Damoh to protect a part of them from fire, yet under existing methods ultimate improvement of the areas could not be expected save by taking up further tracts and constituting them Reserves. He indicated areas in the districts which he visited, from which he considered additional Reserves should be constituted. The main consideration in their selection would be that the areas should

Area in square miles.				
	District.	Unreserved Forest.	Reserved Forest.	Percentage of Reserves to total area of district.
Jubbulpur . . .	3918	328	33	0·84
Damoh . . .	2799	858	10	0·35
Seoni . . .	3053	749	210	6·87
Balaghat . . .	3141	1067	250	7·95
Mandla . . .	4719	2293	113	2·39

consist of good forest soil, though he added the proviso that "forests on poor soil may yet be valuable and worth maintaining and improving as forest Reserves if situated near a line of railway or offering facilities for the export of their produce." The weak points in the procedure, with reference to the formation of Reserves and Forest Administration generally as envisaged at this period, lay firstly, in an inadequate appreciation of the possibilities of development in spite of the almost incredible progress in the opening-out of the Province which had taken place under the administration of Sir R. Temple, the first Chief Commissioner; and, secondly, in the policy, which Brandis now advised, of separating the forests into two categories, the Reserves (the areas reserved under the Forest Law then in force) which were to be solely under the administration of the Forest Department, and the unreserved

forests, which were to be under the District Officers, who were to be assisted by the Forest Officers in their management. This was ultimately to give rise to considerable difficulties and, although it may have appeared the easiest way out at the start, was, in fact, a serious mistake in policy. In the Central Provinces the troubles existent elsewhere with reference to the rights or privileges to certain forest produce exercised by the villagers did not exist. Such produce was all paid for, since once the settlement had been made, all waste land, including the forest on it, was admittedly the property of Government. Brandis hoped, as a result of his recommendations, that the area of Reserves would be largely and rapidly increased by merely creating Reserves from the unreserved forests. He did not foresee that here, as elsewhere, the Deputy Commissioners of districts would be unwilling to give up their jurisdiction over the unreserved areas which, once constituted Reserves, passed out of their hands altogether. Even in the case of the new Reserves he advocated he did not appear to consider it possible, owing to the smallness of the Forest Staff, that they could be all intensively managed. There would therefore, in practice, be two classes of Reserves, the one intensively managed and thoroughly protected, the other open to grazing and the removal of minor produce, protected by boundaries but within which even villages might exist. In these latter, said Brandis, it would be necessary to guard against the growth of prescriptive rights. Fortunately perhaps, in view of the defective staff, this state of affairs did not arise, for the above-mentioned reason. The work in the blocks under intensive management would be fire protection, endeavours made to increase lac-production, improvements by sowing and planting, climber-cutting and other operations. Under fire protection it was pointed out that some of the existing Reserves in which fire protection had been commenced were on very poor soil, and the question of continuing fire protection in such areas was seriously considered. But Brandis rightly considered that, at that time, to give up the protection from fire of any forest in which it had been attempted would be wrongly construed by the people as an open acknowledgment that it was unnecessary, and that therefore it should be continued in all areas where it had been started, i.e. in two selected blocks of the Satpura Reserve, in Pandratola, in the Banjar Forest, in Jagmandal, Choharighogharh and Barela, and in Singrampur and Bijeraghogharh. But in future the Inspector-

General said that fire protection should only be introduced in those areas "which have good soil and give promise of good timber and other produce, and which offer facilities for the export and utilization of their produce": a rather dangerous precedent to lay down. In spite of the above remarks, Brandis reiterates in his Report that he is not contemplating making two classes of Reserves, but in practice it is difficult to see how they could become anything else since the Officer in charge would inevitably have to concentrate on the areas under intensive (and therefore revenue-making) management. It was this over-concentration on the revenue aspect of the question which in the end vitiated many of the suggestions and hopes of the recommendations made at this period.

As a matter of fact, in 1879 all Government Forests were declared to be reserved, and those which at the time remained under the absolute control of the Conservator of Forests were denominated first-class, whereas those under the Deputy Commissioners were defined as second-class Reserves. Transfers from the second class to the first class were to be carried out.

One of the suggestions made by Brandis was that a small museum of woods, bamboos and other produce should be formed at the headquarters of the Conservator. The lines of this suggestion were ultimately acted upon and are now well known, but he also added that a library should be added which should contain "forest maps, reports of the Province, standard works, which, besides professional scientific subjects, should contain a complete collection of settlement reports and published maps of the Province. The library should be so arranged as to serve as a reading-room for the use of Forest Officers passing through, or staying at, the headquarters of the Conservator. Such an institution in every Province would meet a want which has long been felt by Forest Officers, and would at a small expense facilitate the spread of useful information and stimulate the research into professional questions of great practical importance. And, what is further of great importance, it would enable the Conservator to furnish on the spot a great deal of practical information to persons from Europe, who will doubtless in course of time visit India, in connection with the export of ornamental woods, fibres, gums and other useful forest produce."

It is not overstating the case to say that, had these suggestions been given full effect to, the resources in this respect open to keen Forest Officers would have inevitably resulted in a more

rapid development in the progress of the forests of the country, both silvicultural, administrative and commercial progress—a point to which the attention of the younger Forest Services of the Empire may be drawn.

Brandis comments on the great progress which had undeniably taken place in Forest Administration in the Province since he first visited it in 1863 (I, p. 396). Although the selection of some of the Reserves was open to doubt, yet Doveton had accomplished sound work and, amongst other things, good results had been attained with a minor product in the propagation of lac, which it was even then hoped would prove a valuable item of revenue from the Reserves. He also commented favourably on the very small number of forest offences committed in the Reserves, a very different position to that existing in the neighbouring Presidency of Bombay, even when the differences in conditions were allowed for.

The Inspector-General then dealt at length with a description of the Reserves, already mentioned, which he visited, and made suggestions as to their future management, the necessity of preparing Working Plans or plans of operation and so forth, the details of which cannot be entered into here.

As has been mentioned, Brandis again visited the Central Provinces at the end of 1876 and the early part of 1877. He did not publish a Report, but left a series of papers, several of which Schlich published as an appendix to his Report on a visit in 1882–3. The papers so published were very comprehensive and included interesting Reports on the Bori, Moharli and Ahiri Reserves which, unfortunately, it is impossible to do more than record.

Schlich, then Inspector-General, arrived at Jubbulpur on December 17th, 1882, being met by Doveton, still the Conservator. With the latter he marched through Mandla, Balaghat, Seoni and the Nagpur Districts, seeing the first-class Reserves of these districts and “as many second-class Reserves as came in the way.” From Nagpur Schlich went to Warora and thence to Moharli, a first-class Reserve, and then through a series of second-class Reserves to Ahiri, where he examined the Ahiri first-class Reserves “and the adjoining forest lands which had been offered for sale to Government by the Ahiri zemindar.” Schlich states that he considered the areas he visited to be fairly representative of the forests in the Central Provinces, and he was also able to supplement his own observations by information from Doveton, who had been

Conservator since 1868. In his Report (1883) the Inspector-General arranges his remarks under the six heads: (1) Area and Boundaries, (2) Organization, (3) Protection (especially fire), (4) Cultural Operations, (5) Working of the Forests, (6) Financial Results.

So far as the reservation of forests was concerned, the very thing which Brandis said should not, and would not, occur under his proposals, with which the Conservator of Forests agreed, had taken place. Two classes of Reserves, the so-called first and second class had come into being, with the result that little progress had in fact been made in the important work of reservation and protection in the areas outside the forests originally taken up as Reserves and placed under the sole jurisdiction of the Forest Department.

Briefly, Schlich's 1883 proposals were as follows:

(1) To remove all distinctions between first and second class Reserves, and to place them under one general system of management; or, as an alternative to increase considerably the area of the first class Reserves. It was unfortunate that the alternative was submitted since it led to nothing being done.

(2) To strengthen the Controlling Staff by the additional appointment of one Deputy Conservator; also to increase largely, but gradually, the Executive Staff, by the addition of six Sub-Assistant Conservators and a considerable number of Rangers.

(3) To fix and define authoritatively, as early as possible, the external and internal boundaries of all Government Reserves.

(4) To introduce a more systematic working of the Government Forests, regulated by the provisions of Working Plans; or, where this was not at present feasible, to prepare Annual Plans of Operation for the Reserves of each District.

(5) To extend fire protection by the usual means of isolation and watching; but in addition to endeavour to introduce a more general fire protection, by closing any area burnt against grazing and felling and thereby enlisting the interests of the population in the success of fire protection.

(6) To extend cultural operations on a moderate scale, and lastly,

(7) To introduce additional conservancy measures in forests worked under the Commutation, Licence and Khan Tahsil systems.

Amongst the officers who were serving in the Central Provinces at this time were Colonel Jarrett, Captain Losack, Messrs. Jacob, Rind, Moore, Fowler, Thomas, King and Thompson.

Not the least interesting portion of Schlich's Report is his enumeration of the results of the cultural operations undertaken in the Provinces. It will be remembered that Pearson, after a visit to the Nilambur Teak Plantation (II, p. 230), returned fired with the determination to achieve a similar success. Most of the Provinces under the stimulus of the Government of India, were aiming at similar results, the idea having been gradually accepted previous to this time that the destroyed timber forests would be replaced in this fashion.

It is difficult to say how much money was frittered away in these costly experiments. In the Central Provinces two Scottish Foresters were imported expressly to look after the plantation work. It is scarcely surprising that the great majority of the experiments and efforts made between 1867 and 1880 were either complete or partial failures. What Schlich terms "cheap sowings," though no work that is a failure can be so designated, in which teak and other seed was sown broadcast, were almost without exception complete failures. These were undertaken between 1876 and 1878 on areas in Hoshangabad, Nimar and Betul, about 700 acres being operated on in all. The record of the more regular plantings and sowings—of teak and other species—is, with one or two exceptions, a most melancholy one. These were commenced in 1867 and continued up to the time of Schlich's inspection. The Divisions concerned were Mandla, Saugor, Betul, Bilaspur, Seoni (where good results were obtained with teak on small experimental areas), Chanda and Nimar. Between 1879 and 1882 upwards of 120,000 bamboos were put out in the Saugor Division, of which about one-half were alive in 1883. A small batch of bamboos (*Dendrocalamus strictus*), planted in 1873 in Garhakota, yielded their first out-turn of good bamboos in 1881-2, "so that," says Schlich, "eight years may be taken as the time in which artificially raised bamboos of this species will, under ordinary circumstances, in this locality commence to yield a return."

Although Schlich correctly recognized that "the renewal of the forests must be chiefly effected not by planting, but by protection against fire and grazing," yet he advocated a continuation of the efforts to sow and plant in the case of large existing blanks and where it was desirable to improve the composition of the forests; and he instanced areas in which such work might be undertaken. It is difficult to understand the persistence with which these recommendations to sow and

plant were made during these early stages in the career of the Department. The inadequacy of the staff to supervise the forests effectively, even to introduce adequate fire protection, is invariably admitted. And yet withal we find Conservators and Inspecting Officers recommending the mostly ill-trained (when trained at all) and over-burdened staff to undertake some of the most difficult operations of the Forest Officer, the raising and planting out of young plants, or the sowing of seed, of species with which he had little acquaintance, and in localities of which to the same degree he lacked the vital knowledge. The ignorance displayed upon the difficulties of work of this nature in India resulted in a considerable waste of money, a waste which was only very partially repaired by a certain amount of knowledge gained from the failures; for the causes of the majority of the latter were, in most Provinces, not recorded in such a fashion as to be useful to later generations of Foresters.

Schlich's recommendations, with reference to the consolidation of the Reserves of the different classes under one management and the reorganization of the Department, were not given effect to, and Ribbentrop, who succeeded him as Inspector-General of Forests (II, 462), visited the Central Provinces in 1885-6 to enquire into the reasons for the delay in their introduction. His able exposition of the condition of the administration at this period is of high interest. Doveton (now Colonel) was still the Conservator, and he accompanied Ribbentrop through the Rajaborari, Saonligarh and Bowergarh Reserves in the Hoshangabad and Betul Districts, up the Tawa Valley, through the Maturdeo Forests and part of the Kanan Forests in the Chindwara District to Nagpur. Later on they proceeded to Raipur and visited the Chattisgarh Division with Thompson, the Deputy Conservator. The party traversed the forests between the Mahanadi and the Joke Rivers, examined the Kantranala and Hathibari Reserves and re-entered the Chattisgarh Plain. From here Ribbentrop and Doveton marched to the Motinala Reserve and went through the Mandla Forests, visiting the Banjar and Jagmandal Reserves and then proceeding to Jubbulpur.

In his Report Ribbentrop deals successively with the different points in administration which he was sent down to animadvert upon. The first was the question of the existence of the two classes of Reserves and the friction which had been engendered therefrom. In 1886 the area of the first-class Reserves was 3505

square miles, and of the second-class 15,929 square miles, or 19,434 square miles in all. Ribbentrop, in his Reports, is always downright and outspoken in placing the matter in dispute in its proper perspective from the administrative point of view. On the question at issue he writes :

“ The distinction between the two classes of Reserves is entirely artificial, for they are constituted in the same manner, contain forest growth of the same character, and are intended to fulfil the same purpose. As regards the first point, all Government forests in the Central Provinces, with the exception of a few subsequently acquired by purchase, reversion or exchange, have been declared to be Reserved Forests under Section 34 of the Indian Forest Act. At the time of the Revenue Settlement (Vol. I, p. 397 ; II, 216), 36,000 square miles were made over to the Malguzars, and Government rightly considered that all possible claims which could be made, on the plea of justice, equity and even liberality, had been sufficiently inquired into and amply satisfied ; and it was therefore decided that no further inquiries were necessary under Section 34 of the Forest Act. The result of the Revenue Settlement was that the waste lands not made over to Malguzars at the time of such settlement became the unrestricted property of the State, and the consequence was that the Forest Reserves formed out of these lands were, and are now, entirely free of rights. This holds good for the second class Reserves, as well as for those of the first class, and, in this respect, no possible objection can consequently be entertained against the amalgamation of both classes under one management.”

With regard to the second point, connected with the forest growth, the difference in density and so forth existing was due to the fact that the first-class Reserves were at a greater distance from the markets and had, moreover, been protected against fire for a number of years and were therefore inevitably in a better state than the second class, which had to bear the full brunt of exploitation whilst being without any protection. The only way to secure equal treatment for all the forests was to amalgamate all the Reserves under one management. With reference to the third point, the forests of either class had to fulfil the same objects. At that time the demands upon them were in accordance with the existing population and market requirements. With the increase of cultivation and population the demands would inevitably rise and render the management more intense. In order to render this management possible a correct administration was imperative. As Ribbentrop pointed out, the idea so long prevalent, which had been inherited from the early days of the

British occupation, that the Forest Department was only there to grow big trees for the requirements of public works and to meet the demands of large markets and the trade generally was an exploded fallacy (though the recent Inchcape Commission appears to have revived this idea). "It was now acknowledged," says Ribbentrop, "that forest tracts intended to supply local demands require the aid of Forest Conservancy." The trouble still experienced was due to the inability of the Local Governments and of the District Officers to credit the Forest Department with the desire to consider the requirements and conveniences of the people at their full value. And in some cases the suspicion in which the Forest Officer was held in this respect was due to his own short-sighted actions. But, this being the position in the Central Provinces at the time, it is scarcely surprising that Schlich's proposals hung fire—for under them, as soon as the second-class Reserves were converted into first-class, they passed from the control of the District Officer (and from a revenue-making point of view they were paying very well) into the full and complete control of the Forest Department. Some districts contained very large areas of these second-class Reserves. It meant, therefore, that the District Officer would have to give up jurisdiction over a considerable part of his district. On the other hand, the local Forest Officers feared that if the whole of the second-class Reserves were transferred to the first class, with the undiminished authority of the District Officers still maintained, the management of the existing first-class Reserves might drift back into the condition of the second-class Reserves, whose management depended in effect on the opinions of the District Officer in charge at the time. Ribbentrop saw the difficulties, but was not prepared to advocate this large transfer of forests to the unchecked control of the Department. He favoured the Forest Officer being made an Assistant to the District Officer, the latter, however, having to consult the Forest Officer in all forest matters. The danger of a District Officer, who had no interest in the forests or the Department, interfering inadvisably in the administration of the forests would, said Ribbentrop, inevitably be controlled by the introduction of Working Plans or even Annual Plans of operations, as had been suggested by Schlich, which would have to receive the sanction of a higher authority. But, to meet the views expressed by Doveton and others, Ribbentrop considered that for the present the Department should be left in uncontrolled

charge of the first-class Reserves, and that only when the whole of the second-class Reserves in a district had been converted into first-class Reserves would it be advisable to place the Forest Officer in charge of the forests of the District as Assistant to the District Officer. The inadequacy of the Forest Staff was one of the reasons Ribbentrop had for advocating the gradual transfer of the second-class Reserves to first class, proceeding district by district, and beginning in the Nerbada Valley, "where the selection had already advanced further than in other districts, and where it was most desirable that a final separation should be effected between the lands to be permanently reserved and those which can be utilized for cultivation." In advocating this procedure, Ribbentrop offered no objection to the suggestion in a Report by Thompson, who had been deputed shortly before to make enquiries into the existing practice in the management of the second-class Reserves. Thompson had proposed that 3200 square miles of second-class Reserves—800 square miles in the Jubbulpur Division, 1500 square miles in the Nagpur, 215 square miles in the Nerbada and 700 square miles in Chattisgarh—should be transferred as first-class Reserves. The Conservator and Chief Commissioner had agreed with the proposal. The Inspector-General pointed out that if this proposal received final sanction an increase in establishment would be immediately necessary, since the mere paper transfer of a second to first-class status would not result in any improvement.

On the 1st April, 1886, the area of the first-class Reserves totalled 3505 square miles, that of the second-class Reserves 15,929 square miles, with an area of 404 square miles of unreserved forests. This gave an area of 16,333 square miles outside the first-class Reserves. If it was accepted that the 3200 square miles of second-class Reserves were to be at once transferred to the first-class, as advocated by Thompson, an immediate increase of establishment would be necessary. Schlich had made detailed suggestions on the subject of the increase in staff which the transfer of the second-class Reserves would necessitate, but nothing had been yet done. Ribbentrop's suggestions for the necessary supervision of the 3200 square miles were an addition of 15 Rangers, 64 Foresters and 320 Guards. He also advocated that all the temporary establishment attached to the already existing permanent Reserves should be made permanent, since experience had already shown that it was by no means excessive. The point

he sought to make plain was that all forests transferred to first-class Reserves would have to come under effective conservancy, a very different thing from the lax methods in force in the second-class Reserves, and that such conservancy could not be given without an adequate staff. He considered that the proposals for increase of staff submitted by Doveton were the minimum possible and made it evident that they did not really represent the true opinions of the Conservator on the subject, but that the latter had feared to jeopardize his chances of securing an increase if he made his demands too large—a position in which Forest Officers have found themselves the world over, and are likely to remain for many years to come. And yet Doveton had clearly shown that the financial position of the Department in his Province warranted a large additional expenditure on establishments—in fact that the maintenance of the stability of the revenue demanded such an outlay.

The following table shows the Receipts and Charges for four periods of four years ending 1884-5 :

PERIODS.	Expenditure.	Gross Income.	Net Income.	Increase in	
				Gross Income.	Net Income.
1869-70 to					
1872-73 .	Rs. 12,60,105	Rs. 19,69,341	Rs. 7,09,236	Rs. —	Rs. —
1873-74 to					
1876-77 .	12,37,199	26,16,807	13,79,608	6,47,466	6,70,372
1877-78 to					
1880-81 .	17,29,477	33,93,634	16,64,157	7,76,827	2,84,549
1881-82 to					
1884-85 .	18,41,139	41,72,502	23,31,363	7,78,868	6,67,206
Total .	60,67,920	1,21,52,284	60,84,364	—	—

This shows a net revenue per annum for the several periods respectively of Rs.1,77,309, Rs.3,44,902, Rs.4,16,039 and Rs.5,82,841.

Upwards of 82 per cent of the gross revenue was realized from forest produce removed by consumers and purchasers. Such a system required a proportionately large staff, not merely for the protection of the forests but also for the realization and control of the Forest Revenue. Ribbentrop pointed out that in the School Circle of the North-West Provinces an increase in the Executive and Protective Staff was followed by an

immediate increase of Forest Revenue, which had previously been stationary for some years. The suggested increase in present staff (there would be some decrease in temporary establishments and a consequent saving under that head) was a Deputy Conservator, an Assistant Conservator, 4 Sub-assistant Conservators, 16 Rangers, 96 Foresters and 529 Forest Guards, involving an additional annual expenditure of Rs.74,981. Ribbentrop committed himself to the view that there was no doubt that this increase in staff would be financially profitable within a near future. And there were two factors which should help—the first, the systematic opening out of the forests by roads, which were at the time practically non-existent, as were houses for the staff and rest houses for Inspecting Officers, the building of which was advocated ; he also looked forward to railway extensions. The second, that an enhancement in rates of forest produce should be made. Thompson had shown in his Report on the second-class Reserves that no increase in the rates of forest produce had been made for years and that the prices charged were very much lower than the market value of the commodity. The suggestion, as regards the increase to be made, was that it should vary with the distance and accessibility of each forest. It will be remembered that the same question came up in the Punjab with reference to the price of deodar (II, p. 267). In fact instances without number could be quoted of the resulting prosperity, increase in population and prices of forest commodities which have resulted from the introduction of an orderly British rule in wild uncivilized tracts. But we find that those responsible for the management, or at least the collection of revenue from the forests, have usually been slow to grasp the altered state of affairs and markets, whereby large profits have gone into the middleman's pocket with a consequent loss of revenue to the State, accompanied by stagnation in the Forest Department concerned.

Since in many parts of the Empire we are far from having arrived at the limits of the revenue possibilities of the forests, it appears to be a point worthy of consideration whether a decennial review of a Province in this connection should not be prescribed. Our Working Plans are usually drafted for ten year periods, at the end of which period they come up for revision. A critical review of the revenue contrasted with the strength of the establishments of the Province every ten years, would, certainly in the past, as this history indisputably shows, have

resulted in a far more rapid expansion of the forest revenues. It would also have eliminated much heart-burning amongst the staff caused by stagnant promotion ; and, perhaps as important, would have given the Department a more highly efficient subordinate staff at a much earlier date. Nowhere are these reflections more incontestably proved and supported than in the position existing in the Central Provinces at this period.

There was little export of timber from the Province at this date, and the Forest Reserves depended for their market on the local demands of the surrounding country—both as regards public works and industrial enterprises, and the requirements of towns and villages. The methods of working the forests were : (1) By Government agency, the Banjar Sâl Forests and the teak forests of Ahiri (*vide* I, p. 321, and II, pp. 228, 238) being the only areas worked in this manner. (2) The licence system, under which any person requiring produce from a Government Forest took out a licence before proceeding to the forest, for which he paid a certain fixed rate which varied in different parts of the Province. To render it easy for the people to obtain these licences they were sold by the Forest Department, Post-masters, Police Officers, Tahsil Establishments, Schoolmasters, etc. The licence vendors, except the Forest Department, received a commission on the sales. This system had worked well. (3) The Khan Tahsil system, which was a modification though not an improvement on the licence system. Under this (it was in force in other Provinces) the purchaser proceeded to the forest without hindrance, removed the produce he required and paid for it on passing out of the forest at one of a series of stations established on the main lines of export. The system gave great opportunities for dishonesty and speculation ; and in any event was an impossible one to continue in areas of forests which it was desired to improve and maintain permanently. It was not in general existence in the Province. (4) The commutation system, under which a certain fixed sum per annum was paid, in return for which the payee could supply himself with certain classes of forest produce. The payment was fixed by the plough, the house, the land revenue paid or the income of the payee. As a rule grazing was not included in commutation. Ordinarily, but exceptions were made, commutation was not granted unless the whole village agreed to commute. It was a wasteful system and its restriction as far as possible was suggested. With reference to the other methods it was advocated

that the system by which the licence-holders selected the trees they wished to remove should be gradually superseded by the method of departmental selection and marking—an obvious necessity if real improvement was to be possible in the forests. Also that the right to collect minor produce—not daily necessities—should be sold by public auction.

Schlich had advocated, quite correctly, the preparation of Working Plans for the more important Reserves and Annual Plans of operation for the others. All second-class Reserves transferred to first class, as he recommended, were to have either Working Plans made for them or Annual Plans of operations. Neither existed in the Province at the period, nor had any steps been taken in the matter up to the time of Ribbentrop's arrival. Nor, apart from the controversy over the transfer of the second-class Reserves, can this be regarded as surprising. For the demarcation of the forest boundaries was very far from being in a satisfactory state. The boundaries of the tracts formed first-class Reserves at the time of the Revenue Survey were in order and laid down on the maps, and fire protection had been successful in their case, the only forests to which it had been extended. Those of the second-class Reserves, as Schlich pointed out, were in a very unsatisfactory state. It had been suggested that all the available strength of the Department should be concentrated on this boundary work in order to bring it to a satisfactory conclusion at an early date. The work had proved far more difficult than was anticipated and had made little progress. No attention or supervision of the boundaries of the second-class Reserves had been maintained by the District Officers since they were originally laid down during the settlement, with the result that in many cases boundary marks had become obliterated; the *patwari* maps did not, as a rule, represent the delineation on the ground; and the Settlement Records very often did not agree with either the maps or the boundaries on the ground. This was a hopeless position in a matter of very great importance, involving, as Ribbentrop pointed out, the final demarcation of upwards of 8,000,000 acres of forest land. It was essential that the work should be accomplished as soon as possible, and it should not be retarded, says Ribbentrop, by "the loss of a few thousand acres here and there owing to disputes." As regards the procedure, the boundaries of tracts transferred to first-class Reserves since the time of the Revenue Survey and of those which it was proposed to transfer at the time (the 3200 square

miles) should be first settled and after them, in order, the Forests which came up next for transfer. This meant a great deal of heavy work before the Department, and Ribbentrop could not promise any help from the Forest Survey branch (*vide* II, p. 480) for several years—nor would it be useful till the boundaries were actually laid on the ground. It is not surprising, therefore, that the suggestions made both in Schlich's and Ribbentrop's Reports with reference to the preparation of Working Plans could not be attended to, nor a provisional Working Plans branch be established as soon as it was hoped. Annual Plans of operations were introduced, in fact they became general throughout India, but of necessity progress with Working Plans became almost an impossibility in those Provinces which had enormous charges managed by a very inadequate staff, both in numbers and, save the Controlling Officers, in training. Progress in Working Plans had made little way in the Province at the end of the century. A number of plans had been prepared, but they were based on very inadequate enumerations of, and with only a superficial knowledge of, the growing stock. They were consequently of little value.

On the subject of the success of the fire protective measures in the Province, Ribbentrop was enthusiastic. It will be remembered that Doveton was the Officer who had made the first successful attempt to protect a forest from fire in India in the case of the Bori Reserve (II, p. 224), and as Conservator he had protected his first-class Reserves from fire with greater success year by year and at a diminished cost, the charge being about 3·7 pies per acre in 1883–5. But, of course, the protection so given was to a fraction only of the forests. A much more ambitious programme was now advocated under which protection should be extended to additional areas at an annual average increase of 1000 square miles. The selection of the areas would have to be done with care and they would have to be protected by cleared lines. The suggestion made in 1882 of endeavouring to protect extensive areas without isolating them by cleared lines, but by punishing the neighbouring people by closing to grazing all areas burnt, had proved a failure. There was plenty of grazing to be had in the Malguzari Forests outside the Government areas, and consequently the closing was no detriment or punishment. One of the reasons for the rapid extension of fire protection in the Province was due to the remarkable effects on reproduction, and forest growth

generally, observable in the areas which had been under protection for some twenty years. These were so marked as to permit of no doubt as to the value of such protection in the Province; and they put an end at length to the fallacy that forests of this enormous size could be ultimately renewed by planting and other cultural operations. Broadcast sowing done by Forest Guards on open blanks where it was hoped it might be successful should be encouraged, but the real secret for restoring the forests was by closure and protection from fire and excessive grazing, and the energies of the staff should be devoted to this work. Ribbentrop suggested that enquiries be instituted as to the possibility of commencing the protection of parts of the Malguzari Forests from fire. The following striking extract from his Report merits reproduction :

“ The increase in the value of the growing stock is everywhere so striking—and this is particularly the case with the fire protected forests of the Province—that we are justified in promoting this general improvement by every means in our power, even at the expense of money that should yield no immediate return. It is quite impossible to gauge the increase in capital value referred to, without having recourse to valuation surveys of the most elaborate kind; and even then much would remain that could not well be compared with pre-existing conditions. Suffice it to say now that what was described fifteen years ago as land useless for forest purposes, as tracts containing nothing but ‘ sheet ’ rock, etc., are now covered over with promising young trees, whilst overworked and partially recovered forests have been restored in such a way as to be no longer recognizable. Everywhere promises of future gain attract the eye, and riches that are beyond our means of calculation, since, with each year of protection, the soil improves in its productive powers and this improvement is of course shown in a corresponding measure in the vegetation that the soil supports.”

In 1899-1900 the total area of forests under the Department amounted to 19,096 square miles, of which 18,915 square miles were reserved and 181 square miles unclassed forest (22.09 per cent of the whole Province). The total area under Working Plans at the end of the century, or for which plans were in preparation, was 15,668 square miles. This area, however, gives a rather false impression of the position, as many of these so-called plans were little more than “ paper ” ones. The revenue for 1899-1900 amounted to Rs.12,97,490 (preceding five years’ average, Rs.13,75,958), showing a surplus over expenditure of Rs.21,670 (preceding five years’ average surplus was Rs.1,97,298).

A severe famine was experienced in the Central Provinces and

parts of Bombay in 1899-1900. In the *Review of Forest Administration in British India, 1899-1900* (p. 38), Hill, the Inspector-General, draws attention to the value of the forests during such calamities: "The State Forests were thrown open freely to the people during the severe famine of 1899-1900, so that they were able to remove all edible products free of charge, and all other minor products except *harra* and *lac*. The gregarious seeding of bamboo in some districts afforded an excellent food supply, which was the means of enabling a great number of people to do without relief for two or three months. The report on the famine in the Central Provinces in 1899-1900 bears ample testimony to the great value of the forests in a time of scarcity, and it is stated therein that the opening of the forests to the people was one of the most useful measures of relief in the Province." Hill quotes the following extract from the Report as giving some idea of the financial value of the concessions: "The money-value to the Forest Department of these concessions by no means represent their real value to the people, but the amount even of this is substantial. For the whole famine period (September, 1899, to October, 1900) it is estimated by the Forest Department at the following figure: Timber, Rs.3627; Fuel, Rs.62,929; Bamboos, Rs.49,201; Grazing and grass, Rs.1,96,562; Edible produce, Rs.71,059. Total: Rs.3,83,378." This produce was all granted either free or at reduced rates. "In addition to this, the value of forest produce given to relief camps and kitchens aggregated no less than Rs.54,897, while forest revenue to the amounts of Rs.54,937 and Rs.32,154 was suspended and remitted respectively. The total loss to the Department has thus amounted to more than Rs.5,25,000, not counting the heavy cost of grass-cutting operations. Advances were also made by this Department to cultivators in forest villages. The forests have no doubt suffered some loss from this free access of the people to them, but they were intended for the general good, and the damage done has been incommensurate with the benefit to the people and the help given to famine administration."

BERAR

It will be remembered that in the account given of the Berar Forests in a former chapter (II, p. 252) it was pointed out by the Government of India that the progress made in the conservation of the forests was very slow and that practically none had been made in the selection and demarcation of Reserves. Brandis visited Berar in 1869 and again in 1878. After his latter visit he drew up a report on "Forest Administration in Berar." Schlich also visited the Hyderabad Assigned Districts (under which title Berar was known) in the cold weather of 1883 and wrote a note of suggestions on the

forest administration. This Report states that forest policy in Berar really dated from Brandis' second visit, and that the suggestions he then made had been the guiding factors in the management up to the time of his (Schlich's) visit. And some good officers had been associated with the work. Major K. J. L. Mackenzie, who had been connected for many years with forest administration in the Melghat, was at the time of Schlich's visit Deputy Commissioner at Ellichpur; Mr. A. T. Drysdale was Conservator of Forests, Berar; whilst Mr. C. Bagshawe, who had started his service in the north, and Mr. J. Ballantine, who had been in charge of the Melghat Forests for fourteen years, were both Deputy Conservators.

In 1881 two-thirds of the Province was under cultivation and one-third, or 6365 square miles, was so-called waste. Of this latter 1713 square miles were culturable, while 4652 square miles, about one-fourth of the Province, were unculturable. The requirements of the population in forest produce were obtained from this latter area and the question under consideration at the period was whether the area of 4652 square miles could be considered sufficient to provide them or whether they were more than sufficient. From enquiries carried out by Doveton in the Central Provinces it had been estimated that in those Provinces the requirements of the population in timber, fuel, bamboos, grass, etc., might be placed at 12 maunds per annum per head. On the assumption that the requirements in Berar were much on the same level, with a population of 2,672,673 (1st April, 1881) 4000 square miles of forest area would supply the materials and, if grazing was added, the total area of 4652 square miles of waste should suffice. In addition to this area there were also still 1713 square miles of culturable waste which, till it came under the plough, would continue to yield forest produce. But since, with this area under the plough, the population would then be greater, it was held that the forest area in Berar would require skilful management. At the period in question forest produce was being imported into Berar from the Central Provinces, whilst, on the other hand, materials from the Melghat were being exported to the Central Provinces. Schlich expressed the opinion that the imports into Berar from the Central Provinces would "very likely cease after some time," though he gave no reason for the statement. In the case of problems such as this experience has since taught us that other factors have to be given consideration. On the face of it it would appear from the

above figures that with the eventual increase of population the area of forest would be insufficient to support them. But the existing growing stock was far below that which might be anticipated per square mile under prolonged and careful administration. A greater difficulty lay in the uneven distribution of the forest area. Out of the six districts in the Province 3363 square miles of Government Forest were situated in the Ellichpur, Wun and Basim Districts, whilst the Amraoti, Akola and Buldana Districts had only 1061 square miles between them. So far only 1086 square miles had been set aside as State Reserves and 308 square miles as District Reserves, the latter not being protected from fire. The troubles of this period, and they lasted longer in Berar, as in some other Provinces, were often chiefly due to a careless or mistaken policy in the classification of the forests into different classes. The introduction of a forest policy into a country, where the forests have been looked upon more or less as public property to the extent of supplying ordinary daily requirements, was difficult enough. But the steps taken, often without any just cause, to pander to the people led to dissatisfaction which subsequently resulted in far more difficult situations. The position was a difficult one, but Brandis had not always met it in the only possible manner if after trouble was not to result. So far as the people in the neighbourhood of the forests were concerned, the classification into different classes was bewildering, and this hindered progress. At the time of Schlich's visit to Berar a re-classification of all District Reserves, unreserved lands and grazing grounds was in progress. The Officer in charge was engaged in arranging the areas under the following heads :

- (1) Woods, that is, land set aside for the production of wood.
- (2) *Ramnas*, or land set aside for the production of grass, especially for civil stations and towns.
- (3) Permanent grazing grounds, sufficient for the number of cattle then existing.
- (4) Land available for the extension of cultivation. It was hoped that about 3000 square miles would be allotted to the first three heads.

A draft Forest Regulation was under consideration at the time and it was actually proposed to classify all these reserved lands according to their various uses, i.e. State Reserves, *babul bans*, *ramnas* and grazing grounds, thus fixing definitely the uses to which the particular areas were to be put and making rules for each class. All these areas were free of rights and indisputably Government property and, therefore, their legal

status being the same, it was only necessary to notify them all as Reserves under the Forest Regulation and then their management could be decided upon from time to time as conditions and demands required. Once notified as reserves it was pointed out that no areas could be alienated without sanction of Government, and no rights could accrue over them. As Schlich said, the Administration appeared to have lost sight of the fact that the Reserves, in their widest sense, were all for the supply of the requirements of the people of the country and they should be so utilized "with due regard," he adds, "to the production of a revenue from these estates to the State."

It has been mentioned already (II, p. 473) that the Berar Forest Law was passed in 1886. There was very much the same trouble in the mixed management of the forests in Berar as existed in the Central Provinces. The State Reserves were under the Forest Department, the District Reserves under the Deputy Commissioners, whilst the unreserved forests were managed partly by the Deputy Commissioners and partly by the Forest Department. The proposals made here were the same as those described above. Schlich evidently preferred the system which Brandis had suggested for Madras, where for one thing the conditions were very different, that the Forest Officer should become a mere Assistant to the Collector, the latter having full executive power. In the opinion of the writer, Brandis made a great mistake in proposing this method. The modified system in the Central Provinces or the one introduced in the North-West Provinces were eminently preferable.

In Berar, Schlich proposed that the forests of each district should be placed in charge of a Forest Officer, who should be placed in official connection with the Deputy Commissioner under one of the systems in force. The three major charges would be under Deputy or Assistant Conservators whilst the three minor ones would be under Sub-Assistant Conservators. A fourth Sub-Assistant would be required to be attached to the Ellichpur District, which was the heaviest charge. Since the Conservator's charge was a small one he would be able to work out the details of the work in the smaller charges to be controlled by the Sub-Assistants. The problem here, as elsewhere at the period, was how to get the Sub-Assistants. These would have to be trained at the School at Dehra, but it was thought that the Government of the North-West Provinces and Oudh

might be able to spare one or two "trained Assistants," thus showing how far ahead, in spite of the slow commencement, the North-West Provinces had reached by that date.

The largest block of the Reserves at this period (609 square miles) was situated in the Melghat, in the Ellichpur District, and considerable progress in administration had been made. Including the unreserved forests, the total area was estimated at 1546 square miles. The Reserves consisted of the Bairagarh (425 square miles), the Gugamal (180 square miles), and Chikalda (4 square miles), the latter having been demarcated in 1880 in order to secure an adequate supply of wood and grass for the station of Chikalda. The Bairagarh Reserve had been demarcated by Mackenzie in 1866, and the Gugamal Reserve (previously a district reserve of larger area) in 1878. These two Reserves formed a continuous block of teak forest of 605 square miles in extent. Brandis had proposed that an additional Reserve of 50 square miles should be demarcated in the vicinity of Jiri with a view to bringing the *anjan* (*Hardwickia binata*) forests in that locality under conservation. Owing to the difficulty of providing grazing for the inhabitants in the neighbourhood, the Resident had not as yet sanctioned the step; and Drysdale expressed the opinion that as the Reserves in South Berar included an area of 80 square miles of anjan, the matter was not of great importance—a short-sighted outlook unfortunately only too common at the time. The forests of the Melghat were rather fortunately placed; with the exception of a portion of Bairagarh on the north and east, which adjoined the Central Provinces, the unreserved forests formed a ring around the Reserves, with an outer ring of *nakas* or toll stations, where the royalty on all produce leaving the forests was collected, surrounding the whole. Both Reserves and the unreserved areas were honeycombed with cultivation, a population of nearly 43,000, of whom three-fourths were Kurkus and Gonds, living inside the forests.

Dhya cultivation had been stopped for a number of years past, and efforts were now being made to concentrate the cultivation into black soil villages. In this way the number of villages in Bairagarh which five years previously had amounted to fifty-seven had been reduced to nineteen, and it was hoped to reduce them to nine, covering an area of 70 square miles in the two Reserves, leaving 535 square miles of forest.

Brandis had suggested the opening out of the forests by roads, and considerable progress had been made in this respect, the Public Works Department having built 47 (15 unmetalled) miles and the Forest Department 134 miles, the latter unmetalled. It was proposed that an annual grant of Rs.10,000 should be allocated to the latter Department for the next ten years for road construction, with which 138 miles of roads would be constructed. The Public Works were

also to build another 83 miles. All the Public Works roads would be main lines of export, those of the Forest Department feeder roads.

Fire protection in the Reserves had been as successful in Berar as in the Central Provinces, success during the previous five years having been almost complete, the cost being about Rs.3 per square mile. To Ballantine is awarded the main credit for this remarkable achievement. To some extent it must be attributed, however, to the method of working the forests. For many years past this, Schlich says, had been based on the following considerations : (1) To treat the Reserves with a view to their improvement. (2) To enforce no restrictions in the unreserved forests.

When laid down these prescriptions were sound, since the first Reserves had to be demarcated and the people educated to the idea of closure. But in most provinces the demarcation of the Reserves, owing to varying difficulties, proceeded very slowly. Thus, as Ribbentrop was the first to point out, the absence of restrictions in the unreserved forests, when it had been determined what area of permanent forest was necessary to the Province or District, the persistence of indiscriminate felling of the best trees in these unreserved forests when, rather, the felling should be done under the eye of the Forest Officer, or at least the trees should be selected and marked by him, was a negation of the first principles of a true forest policy.

True, revenue was made thereby—but at what a cost was only to be realized later. Schlich recorded that the principle of non-interference in the unreserved forests had only been departed from in one instance, when the rate due on teak bullies (poles) was raised from 1 anna to 4 annas each, with the view, surely justified, of reducing the number cut annually. He remarked in his report : “ Considering the large area in the Reserves and the immense stock of young trees growing in it, I am of opinion that no restriction need be imposed on the cutting of teak bullies outside, and I should suggest that action be taken accordingly.” He suggested that the rate might be fixed at 2 annas instead of 1 anna.

The Reserves up to date had been worked at a loss, but there was a surplus on the total area of forests, though the revenue had fluctuated. The falling off in 1881-2 was ascribed to the check put on the felling of the teak bullies in the unreserved forests. The opening out of the forests by roads would, it was expected, lead to a rapid rise in the revenue, especially in that from bamboos. The total receipts in 1878-9 were Rs.1,22,255, and charges Rs.52,448 ; in 1880-1, Rs.1,11,069 and Rs.59,940 ; and in 1882-3, Rs.1,25,709 and

Sowing and planting of teak had been undertaken in the Province, as in the Central Provinces, with more failures than successes. Frost and rats were considered by Brandis to be the principal

dangers, whereas Schlich thought that the former was chiefly to be feared. He records that whereas the plantations made on low-lying land had been generally failures, those situated on the lower parts of the slopes, with a certain amount of cover, had done very well and had produced healthy saplings. He was therefore of opinion that sowing and planting should be continued in the future, but that the localities for these operations should be carefully selected.

In 1899-1900 the area of Reserves was 4176 square miles, 725 square miles of which were under Working Plans. The most important teak forest was the Melghat. The revenue for this year was Rs.4,78,230, with a surplus of Rs.2,43,850.

CHAPTER V

THE PROGRESS OF FOREST CONSERVANCY IN AJMÉRE-MERWARA (RAJPUTANA), 1871-1900

IN the previous pages of this history the serious results which followed the destruction of the forests in parts of the country have been alluded to (I, p. 210; II, p. 555). One of the most important aspects of this question, apart from the grazing and fuel, is the interference which the disappearance of the forest on the catchment areas occasions with the water supply of the neighbouring areas. This question may be regarded as quite apart from the problem of the actual influence of forests on the general rainfall of the country. In dry arid regions there is now little reason to doubt the beneficial attributes of the forest, even of scrub growth, as a water holder; whilst in addition a more plentiful supply of grass is obtained in the areas occupied by the forest growth. In no other part of the country has this been more marked than in the history of Forest Conservancy in Ajmére-Merwara. It has been shown (II, p. 553) that the whole of the waste and forest lands in these British districts were handed over to the people at the Settlement made by Colonel Dixon in 1850, the Government relinquishing all rights in the lands. The inevitable result followed. The forest disappeared, the areas became barren and unproductive, and the water supplies diminished and became uncertain. Tanks and wells, constructed for irrigation purposes at great expense by Colonel Dixon, became functionless; and embankments built to hold up the water in valleys were burst owing to the rush of water during heavy rainfall down the bare hill-sides, no longer protected by the forests. As has been mentioned, Rajputana was subjected to a terrible famine in 1867-9. Brandis visited the districts in 1869 and painted with a vivid pen the contrast presented by the British area and the adjacent territory of the Thakur of Bednor (II, p. 554). In the latter the forest had been carefully preserved as a game sanctuary for pig (wild

boar). These forests provided a plentiful supply of fodder for the cattle of the Thakur's people, whilst on the British side, to quote Brandis, "the cattle had perished, the people had fled, large villages were deserted and the country was almost depopulated by these years of drought and famine."

Colonel Dixon, "who," to quote Brandis again, "for many years governed these districts in an admirable manner, and whose name is still remembered with feelings of sincere gratitude by the inhabitants," had acted, according to his lights, in the best interests of the people of the time. But he possessed no knowledge of forestry or of the enormous value of the forest as a preserver of water in a dry climate. He may well have been beloved of the people, for the waste lands and hills in the Government villages of Ajmére-Merwara were originally the absolute property of Government and the people had no vested rights in them. Yet in his Settlement he presented all these lands to the people, not foreseeing that the gift would ruin and kill off numbers of their descendants within a score of years. It is true that in return for the gift the villagers bound themselves to plant trees and preserve the jungle to a reasonable extent. This engagement they never attempted to keep, however, as has been shown was the case with similar promises made elsewhere in India—and for the matter of that all over the world, as forest history of the past century well exemplifies.

Brandis wrote a Report of his visit to Ajmére-Merwara in 1869 which was published in 1871. In accordance with the suggestions made therein it was decided to acquire certain areas of the hills of these districts and to improve them by protection and planting. As the 1850 Settlement had expired a new Settlement was commenced in 1870. It was during the progress of this Settlement that the lands were to be acquired. As the people refused to agree to the proposals of the Settlement Officer in this connection recourse was had to legislation. Since the people had failed to keep the previous agreement, the lands had in reality lapsed to Government ownership. In December, 1874, the Ajmére Forest Regulation was passed, which empowered Government to take up any tracts of waste and hilly land for the purpose of forming State Forests, certain rights in such lands being secured to the villagers. The chief rights thus secured were the right to cut grass and such wood as was necessary for their household requirements and agricultural implements; also any rights of way which they had been in the habit of using before the areas were declared

Reserves. It was further arranged that two-thirds of the net profits from the management of the forest areas so demarcated should be distributed among those persons who, previous to the taking up of the land, were interested therein.

As a result of the recommendations made by Brandis, two Forest Officers, Mr. E. McA. Moir (Assistant Conservator), and Anwar Khan (Sub-Assistant Conservator), were posted to Ajmére in March, 1872. Under these officers operations were commenced in establishing plantations on certain lands at the disposal of Government and in affording protection to some of the tracts which were to be taken up as State Forests. As a result of this work, under the provisions of the Forest Regulation, a number of tracts aggregating about 64,000 acres were gradually taken up and declared State Forests; and in June, 1875, a set of Forest By-laws, drawn up under the Regulation, was published. The boundaries of the State Forests were surveyed by a party of the Topographical Survey Department and entered on the district maps. It was subsequently decided to be unnecessary to maintain a superior Forest Officer in Ajmére, probably chiefly owing to the fact that it would be long before the forests could show a satisfactory budget, and Moir was transferred to the Punjab in September, 1876. During the four years of his tenure of the post this latter officer had laid the real foundations of forest conservancy, and on his transfer it was stipulated that his services should be made available when required to inspect the Reserves and to give advice as to the work to be carried out.

In December, 1878, Brandis visited Ajmére-Merwara and Moir accompanied him on his inspection, as also, with the permission of the N.W.P. Government, Captain Bailey, R.E., the Conservator of the Dehra Dun School Forests. As a result of this inspection, which Brandis published in a Report dated November, 1879, the latter paid a glowing tribute to the results of Moir's work. This Report has, however, attributes other than those to be found usually at this period in the inspection reports of the Inspector-General. Brandis considers at length the possible future results of forest conservancy in a dry country like Rajputana, the results on the water supplies, the experiments and investigations to be taken in hand with a view to obtaining proof of the beneficial effects of the steps now being taken to reclothe barren tracts and to protect the catchment areas, and the value of the forest in its power to increase the supplies of grass and fodder for the cattle of the villagers.

In its careful consideration of these points, which can only be commented on briefly here, the Report is well worth a perusal ; since some of its shrewd forecasts have since received confirmation.

The following were the Reserves in existence in 1878 : *In Ajmère*—Mohwa Bir and Madar Hill, 2812 acres ; Nagpahar, 2660 ; Taragarh, 1016 ; Srinagar and Bir, 3575 ; Rajausi, 1260. Total, 11,323 acres. *In Merwara*—Chang, 2341 ; Hatun and Sheopura, 1920 ; Todgarh and Barakhan, 40,048 ; Dilwara and Chang Birs, 235 ; Borwar and Kotra, 3923 ; Anspahar, 1466 ; Biliawas, 3172. Total, 53,105. Grand total, 64,428 acres.

The Forest Regulation was not as clear as it might have been in one important particular. It defined the term "villagers" to include the members of the proprietary body of any village, and gave power to the Commissioner, subject to the control of the Chief Commissioner, to declare any other persons or class of persons entitled to the status of villagers. The Regulation did not expressly state that these rights were vested in the inhabitants of certain villages only, but, says Brandis, "it was understood that under the Settlement these rights can only be exercised by the inhabitants of those villages, portions of the areas of which were taken up to form the forest, and that the rights of the inhabitants of each village extend only to the area taken from their own villages." Another point affecting the question was that to some extent the pasture in adjoining villages was interchangeable, that is, the cattle of some villages grazed on the waste lands of neighbouring villages and *vice versa*. Also, "traders and others who hold no land and pay no land revenue *are not supposed* to be entitled to exercise these rights unless they are specially authorized to exercise them." There were elements here of future needless trouble due entirely to lax drafting of Forest Rules. The rights to be exercised were subject to the control of the Forest Officer with an appeal against his orders to the Commissioner. As regards the cutting of grass and wood, other than fuel, the Forest Officer was empowered to determine the season and place of cutting, and could prohibit grass-cutting in areas occupied by young seedlings. He could also close a right of way through the forests provided he opened out one which was a reasonable substitute. It will be observed that these regulations were in many respects carefully framed, not for the protection of existing forests, but with the object of protecting young forests which were in the process of formation or to be formed

in the future in a barren country. The grazing of cattle was also prohibited, but it was laid down that no fine was to be inflicted for trespass in this respect until the areas had been suitably fenced. This brings up a point, by no means common in India at this period, viz. the necessity of fencing the areas to be afforested. This work was essential if cattle were to be kept out in a country where the animals are taken forth to find their sustenance anywhere in the vicinity of the village. By the end of 1878 the length of the fences round different tracts of the Reserves in Ajmére was 56,214 yards and in Merwara 51,808 yards. In March, 1879, the total length of fencing round the Reserves amounted to 70·8 miles, the total length of the boundaries of the Reserved Forests being 185·5 miles. The fences consisted of stone walls or a live hedge of *thor* (*Euphorbia Nivulia*). In Ajmére the areas of Mohwa Bir, Madur and Rajausi were entirely fenced, partly by walls and partly by a *thor* hedge, which had succeeded well. The hedges were planted in March, April, and in 1878 at four years old were 3-4 feet high and afforded complete protection. A hedge planted by Colonel Dixon twenty years previously along the Sohagal road was dense, 10 feet high and in good condition. On suitable soil this hedge was said to last a very long time. Cuttings about 3 feet long were placed in small holes about 6 inches deep and about 1 foot apart. Three parallel lines 2 feet apart were planted. The cost of planting a double line of this hedge at the period was R.1 per 100 running feet in Ajmére. In Merwara the *thor* fence had succeeded in parts of the Chang area but not elsewhere. Stone walls had been built from the commencement of the reservation work. In the western part of the district, which included the large Todgarh tract, the ground was very stony and *thor* was not common; there did not appear any reason why it should not be utilized as in Ajmére, in the eastern parts, where the plant was plentiful. The stone walls were built 18 inches in width and 3 feet in height, the cost, where stone was abundant, being as low as Rs.2·8 for 100 running feet, although where the circumstances were less favourable the price was nearer Rs.4 to Rs.5 for the same distance. Masonry pillars serially numbered had been erected on all portions of unfenced boundary lines. Beyond some additional fencing in one or two tracts Brandis expressed himself as highly satisfied with the efficient manner in which this part of the conservancy work had been carried out.

No grazing was permitted within the Reserves save in the

case of one or two areas expressly opened between October to June. As evidence of the beneficial results which had followed reservation, during the hot weather of 1878 when grass was very scarce in the district owing to the deficient rainfall of 1877, the Todgarh, Biliawas, Hatun, Anspahar, Borwar and Kotra Reserves were opened to grazing during the months April to June, whereby the lives of many cattle were saved. It is remarkable that the people so quickly appreciated the, to them novel, work which was being undertaken in their midst, and furnishes evidence of the tact of the Forest Officers employed; for Brandis comments on the fact that illicit grazing and other offences were by no means numerous, whilst no important fires occurred between 1874 and 1878, although two occurred in the latter year. However, he warned the authorities that with the increase of grass in the Reserves the danger from fire would become greater, and laid down the measures of future fire protection, by burning traces and so forth. The total protective establishment at the time was 5 Foresters and 32 Guards, the average beat of the latter being 2000 acres.

Considerable expense had been incurred in cultural operations and the results were not always favourable, though the experience gained was held to have justified the expenditure. In areas where there were no seed-bearers sowing or planting were, of course, the only methods by which a satisfactory crop could be obtained, since the transport of seed by wind and birds was limited in extent, and too slow a process in any event. Moreover, even the latter means would be accelerated by the presence of a greater number of seed-bearers even though scattered owing to a partial failure of a plantation; or by securing success by means of small plots of *siris* (*Albizzia Lebbeck*), *kikar* (*Acacia Jacquemontii*) and *sissoo* (*Dalbergia Sissoo*), as had been done in the valleys of the Taragarh Reserve and elsewhere. The cultural operations, so far undertaken had been sowing and planting. Nurseries had been established and maintained in suitable places. The chief species used up to this period were *mango*, *jaman* (*Eugenia Jambolana*), *siris*, *doon* *siris* (*Albizzia procera*), *babul* (*Acacia arabica*), *khair* (*Acacia Catechu*), *jinja* (*Bauhinia racemosa*), *kikar*, *Butea frondosa*, *Pongamia glabra*, *neem* (*Melia indica*) and *sissoo*. Brandis, in addition, recommended that special attention should be paid to the raising of trees with light seed or with fruits eaten by birds and game, so as to ensure their spread by self-sown seed, and he gives lists of a number of trees which he considers

would be suitable, many of which he himself noted to be natives of the district. He appends to his Report what was probably the first botanical list of trees drawn up for this region. As an instance of the rate of growth of *babul*, *neem* and *siris* he gives details of an eight-year-old plantation made by the Public Works Department in moist soil and with close planting at the Inspection Bungalow of Siendra in Merwara. His enumeration gave 1261 trees to the acre, from 3 to 25 inches in girth (breast height) with an average height of 30 to 40 feet. The seed was sown in the rains of 1870 with the object of forming a nursery. The plants were never lifted and the above results were attained. The usual method of sowing areas direct had been either by ploughing the land first, from which good results had been attained in parts, or placing the seed in prepared patches. Brandis recommended that pits 6 inches deep should also be tried, the seed being placed both at the bottom of the pit and on the edge. In the latter two cases he recommended that the seed should be sown in the hot weather before the first heavy fall of rain. For the former, since the land could not be ploughed before the rain fell, and for planting, the work was undertaken after the first heavy fall of rain. The chief species raised by sowing were *khair*, *kalia* or the black *siris* (*Albizzia odoratissima*), the Indian elm (*Ulmus integrifolia*), *babul*, *ber* (*Zizyphus nummularia*) and, in sandy places, *Ailanthus excelsa*. Brandis was insistent on further experiments being carried out with the *Dhankra* (*Anogeissus pendula*), which up to date had failed. He pointed out that the seed ripened in January and that possibly it should be sown at once to attain success.

Quoting the classic French examples in the Alps, the Inspector-General advocated a commencement being made with the building of small embankments ("barrages") across valleys and ravines in order to retain the silt and to form soil for planting. With this object in view he appended to his Report a most interesting memorandum on the subject, drawn up by Mr. W. Culcheth, the Executive Engineer of Irrigation Works in Ajmére.

Brandis then deals with the advantages to be expected from the protection afforded by the Reserves. These are far better realized at the present day than they were over forty years ago. But even so, the chapter he devotes to this subject is of remarkable interest, and in perusing it one realizes that the writer was fully aware that he had here a test case which would go a

long way to prove to the Authorities the enormous advantages of forests, not only in dry arid countries such as the one in question, but also in their effect on catchment areas, in maintaining the supply and providing a more equable flow of water in the rivers and streams throughout the country. It is impossible to follow Brandis throughout this chapter. He realizes that the various points in connection with the water supply remained to be proven, the other objects of the reservation, the growth of grass and wood, having already shown the wisdom of the steps being taken. He suggests a detailed system of observations to be undertaken at stations to be established in selected tanks, wells and springs, with the object of taking periodical readings to ascertain the effect of the afforestation on the water supplies. And he quite correctly recommends that in so dry a country where a large proportion of the rainfall, especially of light rainfall, is lost by the rapid evaporation, the catchment areas of the tanks should be reserved and afforested.

The Inspector-General then deals in detail with the results achieved in the existing Reserves, which, considering the few years which had elapsed since the commencement, are remarkable and witness the close co-operation given by the Civil Officers in the new departure. But he takes a wider view and recommends that the reservation of far more extensive areas should be undertaken. One such had been decided upon, the demarcation of the Danta tract, in order to secure the water supply of Nusseerabad from the Danta tank. The Inspector-General recommended that the hills between this and the Srinagar Reserve should be demarcated, which would place the whole of the catchment area of the Bir tank under protection. A number of other areas for reservation were also listed as extensions to existing Reserves or as new reservations.

Brandis proposed that the pay of the staff should be graded so as to afford better prospects, but he did not materially increase its strength. He thereby followed the line of least resistance which he invariably took in this matter. Even here, where there was little hope of a revenue covering the expenditure for some time to come, it is open to doubt whether this economy in staff at the outset of a young and new administration was not a mistake; for, as events have shown, it gave rise for many years to a fixed idea, on the part of the Central and Local Governments, that Forest Establishments should be kept at the lowest possible strength, with the result that the revenue

gradually stagnated whilst much professional work which would have enormously enhanced the value of the Forest Estate remained undone.

The total forest receipts in Ajmére-Merwara for the seven years 1872-3 to 1878-9 amounted to Rs.6,293, whilst the expenditure during the same period amounted to Rs.1,42,136. During a portion of this period the salary of a Superior Officer (Moir) was incurred. Brandis did not consider that he was in a position to advise that a home-trained officer should be placed in charge again. His estimate of the annual expenditure for the succeeding five years was Rs.1800 with a revenue of Rs.2000 only. Nor did he think that the occasional visits of a Punjab Officer, Moir or another, could prove sufficient to maintain the necessary control. He surmounted his difficulty by suggesting that the Conservator of the School Circle in the N.W.P. should be constituted the professional adviser in forest matters to the Commissioner of Ajmére, and that the former or an Officer of the School should visit the region periodically. That Brandis fully recognized the value and importance of the work is evidenced by the following remark made in advocating the above suggestion. "The task to be accomplished by forest conservancy in Ajmére possesses a peculiar interest, as it is the first instance in India in which Government has undertaken the formation of forests with the chief object of improving the agriculture of the district. But apart from this the work here proposed to be done is of an exceedingly varied character, and will be most instructive for the officers employed on it, and for the probationers and apprentices who will receive their training at the Forest School."

Brandis was rather too sanguine. Ajmére came to be looked upon as a white elephant. It is difficult to understand, moreover, how he could have really held the belief that the observations he suggested should be kept at his proposed stations on tanks, wells and streams could have any accepted scientific value when kept by uneducated men under the supervision of, to them, unknown officers paying flying visits and with no controlling authority over them.

Much was done in Ajmére by the end of the century, as the examples quoted by Ribbentrop of the Mendikola Stream in the Mohwa Bir Reserve (II, p. 557) and the effects of the protection of the Danta Reserve (II, p. 559) well illustrate.

But scientific results of inestimable value, both to India and

elsewhere in the world, might have been available had a well-trained Forest Officer with a scientific and mathematical bent of mind been maintained in charge of so interesting a departure.

In 1884-5 the area of Reserves amounted to 144 square miles. It was considered that a larger area of forests would be necessary to provide for the requirements of the country and 32 square miles of forest were to be made into Village Forests.

In 1897-8 20 square miles, comprising the forests of Chang, Borwar, Kotra, Seliberi, Auspahar and Beliawas, were surveyed by a Surveyor of the Forest Survey branch and mapped on the scale of 4 inches to the mile. In the following year a set of simple rules for the conservation and management of Village Reserves was prepared by the Commissioner and was under the consideration of the Government of India. Progress was also made with the construction of roads. Ajmére suffered from the severe famine of the closing years of the century. The Chief Commissioner remarked : " The revised record-of-rights sanctioned by Government could not be brought into operation, as the season of acute famine and scant yield of grass rendered necessary the adoption of special grazing rules with a view to mitigate the distress among the villages." The wisdom of the afforestation work undertaken thirty years before became abundantly manifest. For the people were saved from the worst of the horrors of 1867-9.

CHAPTER VI

THE PROGRESS OF FOREST CONSERVANCY IN THE PUNJAB AND BALUCHISTAN, 1871-1900

IN previous chapters devoted to a consideration of the introduction of forest conservancy in the Punjab reference has been made to the fact that the first enquiries and investigations undertaken mainly referred to the deodar forests in the Himalayan region of the Province. Deodar was the principal timber used and unrestricted fellings had been made by contractors in the more accessible forests in the native states of Chamba and Bashahr. With the object of checking further devastation and instituting a control over these valuable areas it has been shown that leases were obtained by the Local Government from the Rajas of these States, annual payments being made to the latter (II, 255-6). The Punjab Government had also expressed the opinion that all forests similarly situated on the great rivers and their affluents should, if possible, be leased and placed under the Forest Department (II, 261).

A great demand for sleepers had arisen owing to the construction of the Punjab Railways, and the idea appears to have been entertained that the Bashahr Forests might be cut out to supply this demand. This suggestion was vetoed by the Secretary of State for India in his Despatch sanctioning the fifty-year lease of the Bashahr Forests (II, 257).

Allusion has also been made (II, 256) to a "Report on the Deodar Forests of Bashahr." This Report was drawn up in 1865 by Brandis, Stewart, Conservator of the Punjab, and Wood, Conservator in Oudh. It will be necessary to briefly detail some of the prescriptions for the management of the forests laid down then before dealing with the Preliminary Working Plan framed by Brandis and other officers in 1875.

The deodar forests visited by Brandis, Stewart and Wood in 1864 were (1) those between Poinda and Sapni on the left or south bank of the Sutlej River, termed the Lower Sutlej Forests ;

(2) the forests on both sides of the Buspa River, a tributary of the Sutlej, and (3) the upper forests on the Sutlej. These forests were classified into non-available and available forests. The former were those from which the timber could not be extracted by the methods employed up to that time, i.e. rolling the logs down ravines or steep slopes, or making rough dry slides and sliding them down (I, p. 411). The non-available forests were not therefore considered in the Report in question and would only become available "either by converting the timber on the spot into scantling, which can be carried to the river, or by forming artificial slides and improving the tributaries so as to fit them for floating timber." It was stated at the time that "these forests are very extensive, and having only been worked to meet local requirements, they are rich in valuable timber." The available forests were those from which, under the existing methods, timber could be extracted and were the only ones examined at this period; but even in these, many of the forests would only become available after blasting works had been undertaken to render the rivers floatable.

The deodar-producing tracts in Bashahr were divided into five geographical groups containing the following number of trees :

Name.	No. of first-class trees of 6 feet girth and over supposed to be available.	No. of second-class trees $4\frac{1}{2}$ to 6 feet in girth supposed to be available.
I. The Pabur Forests	None	—
II. The Lower Sutlej (below the mouth of the Buspa), on the left side	30,000	—
III. The Buspa Forests	6,000	—
IV. The Upper Sutlej Forests, on the left side	18,000	—
V. The Sutlej Forests, on the right side	4,000	—
Total	58,000	58,000

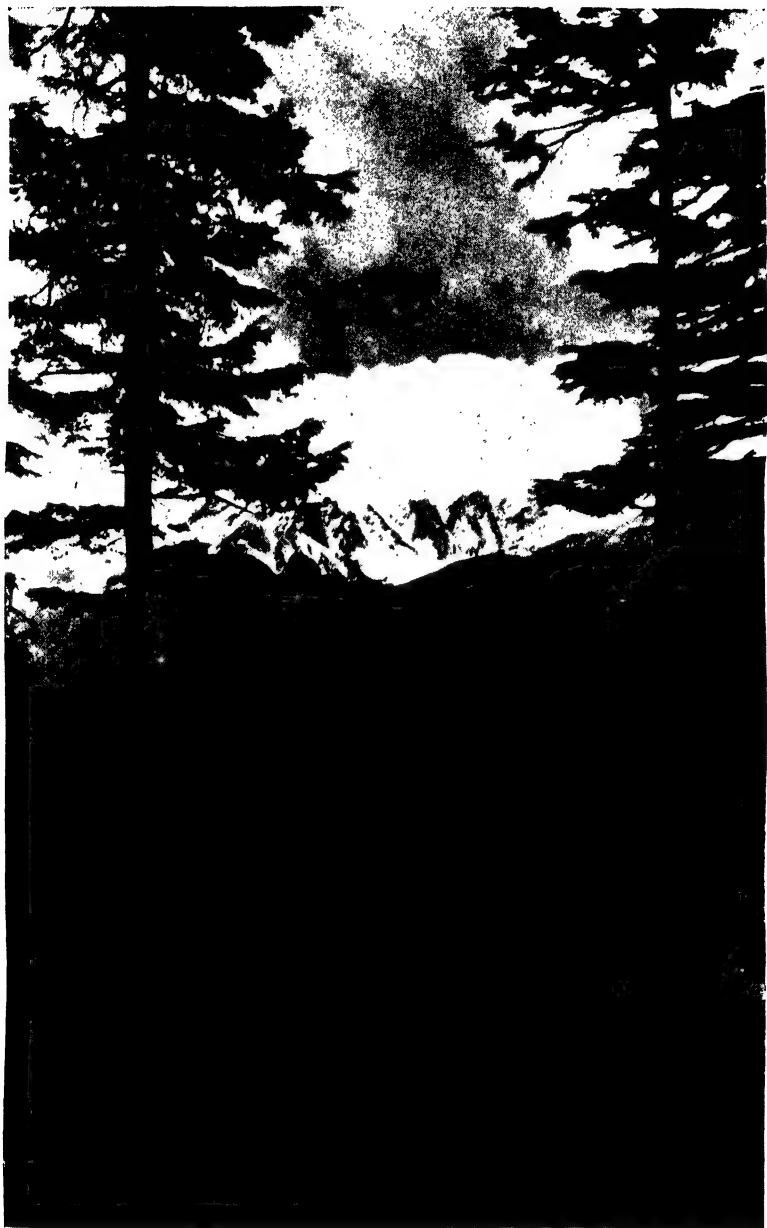
These figures were obtained as follows: (a) forests surveyed, area 3500 acres, first-class trees, 33,400; (b) forests not surveyed, area not estimated, first-class trees, 24,600. It was

example. The largest trees here had attained a height of 250 feet and a girth of 20 feet, the trees being more than 550 years old, the majority being from 150-350 years. The largest trees measured in the region were five giants round an old temple near the village of Kunai between Kilba and Sapin, four of which had a girth of 25 feet 4 inches, 24 feet 9 inches, 23 feet 2 inches and 17 feet 4 inches, whilst on a terrace above the village of Burbani an old tree, probably about 900 years old, measured 34 feet 4 inches in girth.* The largest trees recorded in the region were 39 feet 8 inches, Taranda (Madden), 36 feet, Chasoo (Madden), and 35 feet 6 inches, Soongree (Thompson, Hoffmeister and Cleghorn). The average height of first-class trees below the mouth of the Buspa Valley varied from 100 to 150 feet; further up they rarely exceeded 100 feet, the average being 70 to 80 feet. In the Nachar Forest the average yield of trees felled in 1864 was six logs of 12 to 14 feet in length and measuring 35 cubic feet apiece. In the Upper Buspa Forests the trees yielded only two to three logs apiece on an average. In the Nachar Forests one hundred standing trees and forty-four stumps of felled trees were measured on 2.30 acres, the result being an average of 218 cubic feet per first-class tree and 66 cubic feet per second-class tree.

Carefully compiled and most interesting tables are given in this Report, based on series of measurements of sample plots and linear surveys in various forests and the countings of the rings on numerous stumps. This careful work gave the first statistics on the rate of growth of the deodar and these were accepted by the framers of the 1875 Working Plan.

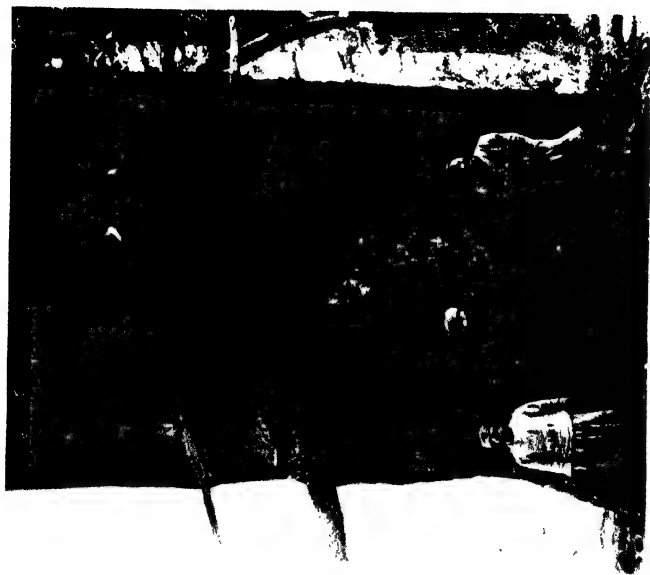
On the subject of the methods he constantly employed and recommended for ascertaining the growing stock of forests, Brandis, in this Report, is careful to give his reasons for adopting them. He writes: "I may here mention that the

* In the Museums at the Research Institute at Dehra Dun there is a section of a deodar tree which had already grown to the size of a fine pole at the time William the Conqueror landed at Hastings.



DEODAR (*CEDRUS DEODARA*) FOREST UNDER REGENERATION, RUANG, UPPER
BASHAHR, N.W. HIMALAYA, 1922

H. M. Glover, photo.



LOWER PART OF STEM OF LARGE DEODAR TREE,
35 FT. IN GIRTH. PARAR VALLEY, LOWER BASHAHR,
N.W. HIMALAYA

H. M. Glover, photo.



LARGE DEODAR TREE, GIRTH 35 FEET, PARAR VALLEY,
LOWER BASHAHR, N.W. HIMALAYA

H. M. Glover, photo.

counting of individual trees, as is done in these Valuation Forest Surveys, is a *primitive and incomplete method for arriving at the valuation of any forest*. When the methods of forest management are further advanced in India, it will be abandoned, and the valuation of a forest will then not be expressed by stating the number of trees but the cubical contents of timber per acre, and the quantity which is annually produced on this area. But under present circumstances the method here described must be used." Results have shown that the method was eminently practical for the time; and is equally so for many forests now coming under first management in other parts of our Empire.

The proposals of the 1864 Report were based on the following ascertained data: (1) The number of first- and second-class trees actually counted on 652 acres of forest in the different geographical regions was 3743 and 4099 respectively. (2) The time required for a tree to increase from 4 feet 6 inches to 6 feet in girth in the quick-growing localities was from sixteen to twenty-nine years, and in the slower-growing ones from thirty-seven to eighty-six years—average thirty-five years. (3) First-class trees immediately available, 58,000. Based on these data, an annual yield of 3000 first-class trees was provided for the first period of sixteen years; after which it was supposed that the trees in the forests not then considered exploitable would furnish the material for the remaining nineteen years at the same rate of yield. In other words, by the time $35 \times 3000 = 105,000$ trees had been felled the second-class trees would have attained first-class size.

From the examination of the forests the authors of the 1864 report were confident that the previous figures of the number of trees taken out by contractors from the more accessible forests of the region were below the mark. The first person to work these deodar forests was Soda Sing. But the first extensive fellings were commenced in 1859 by Arratoon, and between this year and 1863 they estimated that 30,000 trees had been felled, of which, owing to the wasteful methods in force, only a small proportion of the material reached the market, thus confirming Cleghorn's observations (*vide* I, 411). The following forest tracts which they inspected were completely destroyed by these fellings, reproduction being impossible:—Kusthal and Dippi (lower part); Punang (western portion); Kilba (lower portion); Kumkuni and Sapin (lower half destroyed by fire owing to remains of felled trees lying on ground); Shoang (lower part); Scrinche and Yak Bursari (considerable part of); Tanglin (lower portion); Kastiarang and Eastern Runang Forest. At the then rate of working, even with the introduction of sawing and artificial slides, the forests would be completely exhausted by 1884.

The authors proposed to divide the available forests of the region into eight divisions and to work them out in sixteen years, concentrating the working in one at a time.

The non-available forests were classified as follows : forests on the Pabur and tributaries ; those on the Nogri, Choundeh and other streams below Taranda ; Rupī, Shorang, Kandari and other streams on the right side below Wangtu ; Wangar ; Melgad, said to be extensive and fine ; Punang ; Barang on the feeders of the Shaengarang ; Tanglingad ; Upper Teedong ; Kashang and the Malgun Forests below Pangī. The first step to make these forests available would be the introduction of sawyers and the conversion of the timber into railway sleepers.

The Report treats of the other species of trees existing in the region, with protective measures and demarcation, and with the right to drift wood. Also with the necessity of searching for further sources of deodar timber in Jaunsar-Bawar, on the Chor Mountain between the Giri and Tons Rivers, and elsewhere to supplement the resources of Bashahr. In order to carry out the provisions laid down in the Report Lieut.-Col. Batchelor was appointed to the charge of these forests in 1865.

In their orders of 2nd January, 1874, the Government of India stated that after completing the survey of the Dehra Dun Forests, the Forest Survey Branch should take up the topographical survey and the preparation of a Working Plan for the leased forests on the Sutlej in Bashahr. In consequence of these orders, Mr. B. Ribbentrop, Deputy Conservator, was deputed by the Punjab Government to make a preliminary study of the forests on the spot, to demarcate the boundaries of the Reserves by permanent boundary marks, to lay down the lines separating blocks and compartments and to prepare a statement of existing rights in the forests. Ribbentrop arrived at Nachar on June 1st, and to his other duties added the preparation of plans for working the forests " of other pines " for the supply of sleepers to the Indus Valley Line, as large demands on that account were anticipated.

In August the Inspector-General (Brandis) was directed to visit some of the Punjab Forests, commencing with Bashahr. He proceeded to the latter region in September, being joined by Ribbentrop and Stenhouse, Conservator of the Punjab, and by Lieut.-Col. Batchelor, Deputy Conservator, who was still in charge of these forests. After a discussion of the plan of management with these officers it was decided to embody the results of Ribbentrop's labours and their discussion in a joint

report, "in which we have attempted to sketch the plan of working during the next five years, that is from 1875-6 to 1879-80. Before the end of this quinquennium a revision of the present Working Plan, it is hoped on more complete information than we possess at present, will be necessary."

The framers of the Working Plan commenced by stating that they had decided to include all the hill forests on the Sutlej which were under the control of the Punjab Forest Department, as all these forests had one common outlet and should therefore be in one administrative division. Therefore the Working Plan included, besides the Bashahr Forests, those of the Eastern Seoraj and the small British forest of Kotgarh, to which should be added any Government forests in the parganna of Kotkai. All these forests were divided into ninety-six groups, which were regarded as blocks of one large working circle. The Working Plan Report was divided into three parts : (1) General. (2) Descriptive Account of Forest Blocks. (3) Detailed Proposals of Work to be Undertaken during the next five years with the Financial Forecast.

In both the first and second parts the authors refer to the data and the maps given in the 1864 Report, stating that "it will not be necessary in this Report to repeat the general description of the forests given in these documents." Reference is also made to additional information contained in a Journal of a tour made by Brandis in 1869. It is impossible to do more than summarize here the main proposals of these Reports, but it is necessary to study them together in order to realize the position of these forests at the time and the careful steps taken with the object of safeguarding and improving their future growing stock.

It has been shown that it was estimated that 30,000 deodar trees had been felled in Bashahr between 1859 and 1864. From 1864 to 1874 the deodar fellings were as follows: Trees felled by Contractors, 7650; trees felled by the Department in Nachar (1500), Dippi (250), Tikru (120), Kunai (100). Total, 1970. Windfall trees, 1380; trees felled for the Raja on indent and by villagers on permit, 5000. Total, 16,000.

It was estimated in 1864 that the number of first-class deodar trees standing in the available and non-available forests amounted to 116,000. This estimate included the Pabur and Rupin Forests, which in 1874 were no longer included in the Sutlej Division. In this latter year the authors of the Report estimated the deodar-producing tracts at 20,460 acres, supposed

to contain upwards of 108,500 first-class trees. In order to compare the 1864 estimate with that of 1874 the authors add to the former 20,000 second-class trees which in the ten years had passed over into the first class, and also 10,000 trees estimated to stand in the Seoraj Forests, thus raising the total first-class trees to 146,000. Deducting the 16,000 trees felled between 1864 and 1874 leaves 130,000 trees, i.e. 22,000 less than the 1864 estimate. In order to be on the safe side, the previous estimate of the surveyed available forests was reduced in some cases and that of the non-available forests which were not surveyed in 1864 was framed as low as possible. It was held that an exact survey would give both a larger area and a larger growing stock of first-class trees. Since the deodar was found mixed with other species and scattered over the greater portion of the main and side valleys (a distance of some 152 miles) between 7000 feet and 10,000 feet, an exact survey was not practicable at the time, and therefore the estimated figure was kept low. It was also decided to concentrate each season's work as far as possible upon a limited area, so as to facilitate supervision. On this subject the authors continue: "Fortunately, however, there is good ground to hope that ere long deodar timber will cease to be the only marketable produce of these forests, and then a much larger area can be taken in hand, which will largely increase the importance of these forests and will greatly facilitate their management." The other species of timber in existence, of which a good description had been given in the 1864 Report, are then enumerated and their possible uses detailed. Ribbentrop's researches into the working of the fir forests for railway sleepers are alluded to as affording most valuable information, and an extract from his Journal is appended to the Report. His investigations had reference to the areas of silver fir, spruce and *Pinus excelsa* (the two former he terms *Abies Webbiana* and *Abies Smithiana*), his problem being the conservative cutting of 20,000 "pine" trees other than deodar. Ribbentrop examined several forests and his conclusions may be given in the following extract concerning one of them, the Tatra Forest between Sungri and Nachar. The forest consisted of mature *A. Smithiana* and *P. excelsa* in a healthy state, the reproduction, especially of *P. excelsa*, being excellent. He counted the trees and found 4400 first-class trees. He wrote: "I see no reason why the forest should not be worked by two successive cuttings and in that case 3400 trees might be taken out at once. A covered sleeper shoot,

4800 feet long, might be made leading direct into the Sutlej constructed in the first instance as carefully as possible; a tramway should be made skirting the lower part of the forest, and, if the timber was sawn into scantling where it falls, the furthest carriage by coolies would be less than a mile. This, if ever executed, will be one of the most interesting and economical timber works." Many years were, however, to lapse before attempts to work the high-level fir forests were seriously undertaken and during the period deodar timber reigned supreme as almost the only saleable commercial article.

The authors of the 1874 Report discuss the *P. longifolia* (*Chil*) forests and their distribution at the lower elevation, but state that "it would not be right to commence cuttings on a large scale, unless the area cut could be fenced against cattle and protected from fires which are lighted over a large part of these slopes in spring to produce fresh pasture. The most productive *chil* forests are Kandarra in Pandrabis, and Tach or Sandur between Tranda and Serhn."

The only minor produce then known worthy of collection was (a) bark of *Desmodium tiliaefolium* and *argentum* for paper materials, both very common; (b) resin of *P. excelsa* and *Abies Smithiana*. Little was known about the methods of tapping these trees, but it was considered that the former should be treated as the maritime pine in the Landes in France; the latter in a manner similar to the European spruce (*Picea excelsa*); (c) sticks of the hill bamboo (*Arundinaria falcata*).

Until more was known as to the marketable possibilities of the species other than deodar, a complete demarcation of the Sutlej Forests could not be undertaken, but it was recommended that the demarcation of the areas in British territory (Kotgurh, Kotkai and Seoraj) should be proceeded with. Demarcation work had already started in some of the more important of the leased forests in Bashahr, but in no case had the privileges of the people to cut material for their own requirements been interfered with. As regards grazing, it was held that the grazing-grounds in the valley were so extensive that it would be no hardship to close all the deodar forests. This was not considered advisable, but it was regarded as indispensable that all exploited areas should be closed and fenced. Batchelor had already fenced a large portion of the Eastern Nachar Forest at small expense and, says the Report, "the result of the measure has been most satisfactory, the contrast between the young growth in the fenced and

unfenced portions being very marked." Owing to the scanty population in this region at that time fencing was considered better than demarcation lines and enforcing the penalties for infringement contained in the lease.

The Report accepts the figures of 1864, already quoted, as regards the rate of growth, with the rider that a proportion of the so-called second-class trees (i.e. between 4 feet 6 inches and 6 feet) at that time were in reality old suppressed trees, many of which would never attain first-class size. In order to be safe the authors, therefore, fixed the maximum annual yield at 2000 trees only for the next five years, although it was recorded that "it is probable that 2000 trees annually is a yield below the present productive powers of these forests, but, on the other hand, it does not appear advisable with our present incomplete knowledge of these forests to fix it at a higher figure." The silvicultural aspect of the problem does not appear to have been considered, viz. that to undercut in this case meant that reproduction, owing to insufficient light, would be deficient or absent. But the authors were only here repeating the mistakes (as now acknowledged) made by French Forest Officers, with far better data on the subject of the growing stock, rate of growth and area statistics, in some of their silver fir forests managed on the Selection System. The conservative storing up of increment against a future sudden demand is not always a safe or correct management—since it may result in maintaining the forest too dense with a consequent absence of natural regeneration.

The Report then discusses the regulation of fellings and thinnings for the following five years, the question of the topographical survey which it was recommended should be postponed, and an increase of the establishment from nine to seventeen men at a moderate increase in cost. The description of the several forests is of interest but too long to reproduce here. It is worthy of mention that the Divisional Officer was recommended "to keep a book called *General Record of Blocks and Groups of Forest* for the entry from time to time of all additional information, so that the result of the working and of the examination of the forests may be ready to hand for drawing up a fresh descriptive account at the first revision before the expiry of the first quinquennium."

With the object of undertaking the detailed survey of the areas to be worked during the second quinquennium it was suggested that an officer from one of the *rakh* or plantation

divisions in the Punjab plains should be deputed to the Sutlej Division during the summer months. This work should start in Pandrabis and would be accompanied by the opening out of side valleys by blasting work in the stream beds and the Working Plan provided a sum of Rs.25,500 for the quinquennium for the salary, etc., of the Officer in charge and for the blasting work. The operations laid down in the Working Plan—fellings and improvements, etc.—were to be concentrated between Nachar and Barang. It was laid down that whenever large areas of poorly stocked deodar were to be fenced nurseries should be established to be stocked by sowing and the planting out of one-year old seedlings. Rs.3,000 annually was allowed for fencing and nurseries. Timber operations were estimated to cost Rs.56,643 annually or at the rate of $4\frac{1}{2}$ annas per cubic foot. The revenue to be realized was estimated at 10 annas per cubic foot for deodar and 4 annas for *P. excelsa*. The amount payable to the Raja on account of timber estimated to be felled would be Rs.8,225 per annum. "This," says the Report, "is a higher sum than has ever been paid to His Highness since the lease was concluded." A sum of Rs.17,500 was allotted for the five-year period to be spent on roads, bridges and buildings.

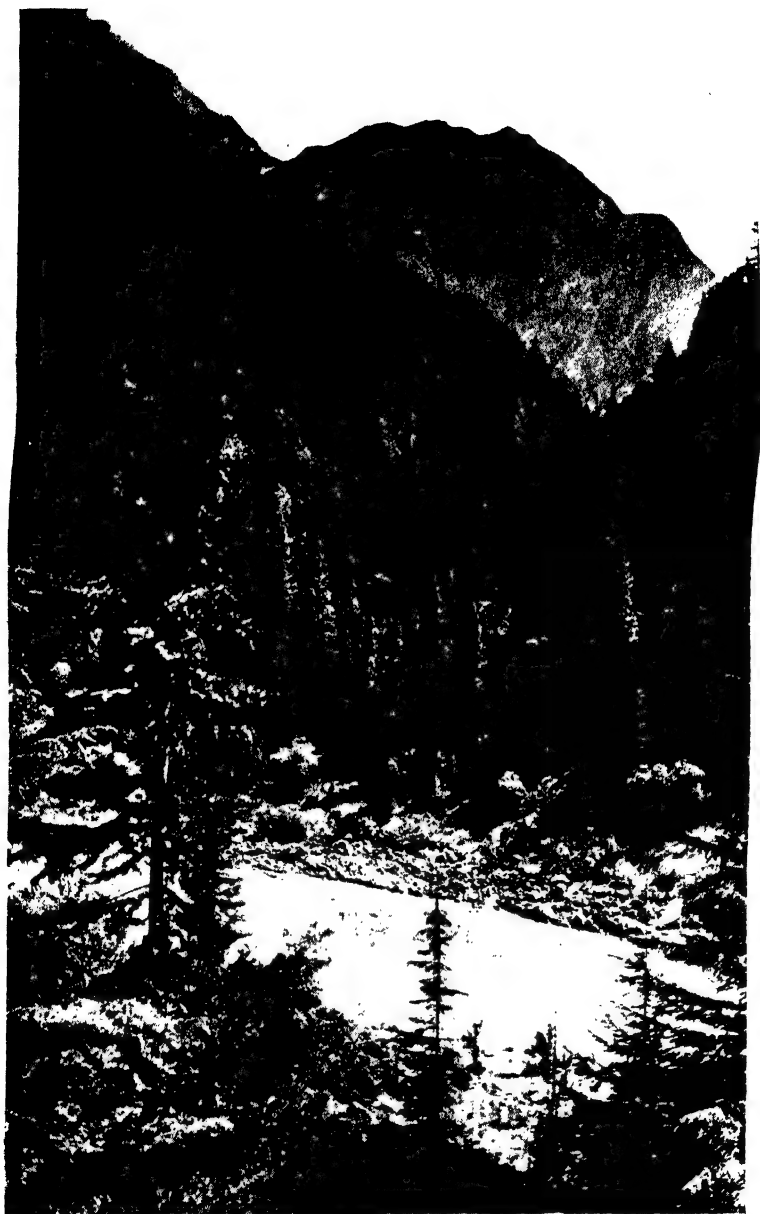
In concluding their report the authors make some interesting remarks (for that time) on the method of collecting the data for the revision of their plan and for the determination of the yield which "must, if possible, be based upon a complete enumeration of first-class trees, at least in the more important forests; the enumerations to be recorded in a special Register of Valuation Surveys." The other books to be kept with this object in view were the General Record of blocks or groups of forests, already alluded to, a record of timber operations, and record of works of improvement and reproduction. The various Statements and Appendices attached to both Reports (1864 and 1874) give most valuable statistics relative to these deodar forests at that time.

This rather lengthy review of these two reports has been given with a set purpose in view. For it shows effectively how the great deodar forests of the Western Himalaya were saved by the Forest Department from destruction, a destruction which in a few short years had already assumed appalling dimensions. Had the Department not appeared on the scene in time to recognize the position and taken it in hand, the deodar forests would have certainly disappeared, and it is

difficult to estimate the disastrous effects which would have inevitably followed that disappearance.

It will be remembered that in his review on the Forest Administration Report for 1865-6 the Lieutenant-Governor, amongst other measures, recommended that the planting out of young deodar trees should be proceeded with vigorously (II, 272). In his review of the Report for the following year the Governor-General remarked that the time had come "when the propriety of undertaking those important operations (i.e. planting) on a large scale may be considered" (II, 277-9). It had been suggested that one of the trained Forest Probationers from home should be appointed to the charge of this work, and Ribbentrop, on joining the Department, was given the post. As an outcome of the experience this officer gained both in the hills and the plains at Changa Manga (to be dealt with later), Ribbentrop published in 1874 a small book entitled *Hints on Arboriculture in the Punjab*, intended for District and Forest Officers. In his introduction the author says: "The following pages form a portion of a work which I intend to publish in the shape of Pamphlets for the use of untrained Forest Officers." He might have added, for trained Forest Officers also. For this little book is a mine of valuable information based on practical experience of how to carry out sowing and planting operations with the more valuable species of trees found in the Punjab. Some parts deal with the ordinary text-book information on the subject of the preparation and cultivation of the terrain, whether in the nursery or on the planting area, but even here we find interspersed data and references to the soils and species of the areas he was dealing with. Other points refer more especially to Indian conditions. Space precludes more than a passing reference to this pamphlet, which runs to 132 pages with most useful diagrams, but as instances of its contents the following may be mentioned: artificial irrigation in the Punjab; the nature of the surface covering of the soil at Changa Manga and how dealt with; spring, autumn and rains sowings and their results; manner of sowing for different species; cutting down of plants which have suffered from drought, frost, mice or cattle and the results attained; systematic plan of cultivation to be drawn up; and lastly, the cultivation, reproduction and treatment of Punjab trees.

Progress in the leased forests of Chamba State, which were considered in II, Chap. VII, was slow. Departmental working



CEDRUS DEODORA FOREST ON THE CHENAB, PANGI VALLEY, CHAMBA STATE

Photo. by J. H. Luce



GREEN TEAK TREE, 16 FT. GIRTH. TOUNGOO DIVISION, BURMA

Photo. by J. J. Rorie

had been instituted, but the settlement of boundaries, etc., took time. In 1884-5 a small party of the Forest Survey was at work in the forests, but triangulation work was not carried out till several years later. In the same year a Working Plan was under preparation for the forests on the Upper Ravi. This plan was finally sanctioned in 1887-8. It prescribed thinnings and the removal of shrubs, etc., injurious to reproduction and advanced growth. Success at first was unsatisfactory. At this period some improvement was made with communications, sums of Rs.6312 and Rs.8791 having been spent in the Province in 1890-1 and 1891-2, mostly in Chamba and Bashahr. In the latter year 1638 acres were thinned in Chamba, forming the chief operations of this kind carried out in the Province in 1891-2. The provision of Working Plans for the Pangi Forests and for the Bashahr deodar areas was under consideration in 1892-3. As was inevitable there was a decrease in timber production from the Chamba areas in 1895-6.

The Simla Municipal Forests.—In previous chapters of this history (I, Chaps. xvi, xxv) the question of the Simla fuel supplies has been dealt with, anxiety on this subject having commenced to make itself felt as far back as 1853. A certain amount of forest land had been included within the Simla Municipal boundaries, and in 1870 Mr. A. E. Wild, A.C. Forests, was detailed to examine the forests on this area and to draw up proposals for their working. Wild's proposals were submitted to the Municipal Committee by the Conservator of Forests, Punjab, in 1871. They were not given effect to since the boundaries of private estates had not been laid down, only a very incomplete map of Simla being in existence; consequently it was not possible to ascertain the exact boundaries of the Municipal land. A survey of the tracts in question was subsequently carried out and the boundaries of the various estates were permanently fixed; unfortunately, however, the limits of several villages, supposed to number seventeen and situated within the Municipal limits, were not delineated at the time.

In 1875-6 Mr. H. C. Hill, A.C. Forests (subsequently Inspector-General), attached to the Survey Department, and Mr. F. D. A. Vincent, A.C. Forests, prepared a Plan of Operations for the Simla Municipal Forests for the five years, 1877-81, which was published in 1876. They commenced their work by sketching in on the 24-inch scale map the limits of the actual forest to which their proposals were confined,

excluding all cultivation and land bare of forest in the vicinity of the villages which, owing to the boundaries of the latter not being fixed, might not prove to fall within Municipal ownership. The Forest Officers pointed out that the boundary marks of the Municipal estate were mostly very inadequate, the pillars consisting of piles of dry stones often half destroyed which, where the boundary did not follow natural features, were inefficient. The boundary was often very difficult to follow, especially where it passed through dense forest of young deodar poles. Many instances were quoted and the suggestion was made that *pakka* masonry pillars should be erected. The authors of the Report hoped, however, that when the village settlement, which was shortly to be undertaken, was made their provisional boundaries showing the limits of blocks and compartments of the forest might be accepted.

The plan was drawn up for five years only, for the following reasons: (1) The unsettled state of the village boundaries rendered it impossible to ascertain the actual extent of forest land owned by the Municipality. (2) Before a regular Working Plan could be framed grazing would have to be restricted and lopping stopped. (3) The greater part of the forest consisted of young growth, the older parts having been so heavily grazed and lopped that they were not at the time capable of supplying timber of the dimensions it would be found most profitable to produce. They hoped that before the period of five years had elapsed all rights and privileges would have been clearly defined. They insisted that for some time to come all operations would have to be confined to thinnings and cleanings. It was possible to prescribe accurately the work of this nature which should be carried out during the next five years, but they were not able to predict what would be the condition of many of the compartments, now in a wretched and deteriorated state, a few years after they had been protected from cattle and lopping.

The forest area was divided into the following nine blocks: (1) Entrance Valley, 133.33 acres; (2) Chadwick's Hill, 188.82 acres; (3) The Glen, 202.28 acres; (4) Anandale, 214.78 acres; (5) Baresh Valley, 255.29 acres; (6) Elysium, 320.37 acres; (7) Jako, 293.55 acres; (8) Combermere, 229.05 acres; (9) Merlin, 414.39 acres. Total area of forest, 2251.86 acres. These blocks were divided up into a number of compartments, or working units, numbering forty. The total area of land belonging to the Simla Municipality amounted to 3866 acres; this tract, as has been already indicated in previous pages of this history, being surrounded by the territories of several Indian chiefs.

After describing the geological and soil aspects of the tract the authors state that the soil and climate are particularly

adapted to the growth of deodar and *ban* oak (*Quercus incana*), and that these species will doubtless prove the most remunerative. The Report gives evidence of a very considerable knowledge of the silvicultural characteristics of the species to which they add *kail* (*Pinus excelsa*), rhododendron and Andromeda (*Pieris ovalipolia*), the former being more valuable for fuel. The spruce was not common, but would be usefully introduced into some of the deodar compartments where the soil was moist and mossy. Other species were holly, *Prunus Padus*, Himalayan poplar (*P. ciliata*), *Enonymus* and *Quercus annulata*. The authors' notes on the deodar, under which they quote some of Ribbentrop's observations on the seeding of the species, are most interesting. They remark: "Deodar seedlings grow most vigorously under a partial shelter, and it is remarkable to see how the slender top shoot of the tree pierces through the crown of oaks and rhododendrons." The lower slopes of the Simla Mountains were covered with *Pinus longifolia*, and it was noted that the upper limit of the zone of this species passed through Simla. Hill stated that "the tree requires a large amount of light, and if unmixed with other species forms a very open forest" (cf. I, 285).

After commenting upon the irregular and poor nature of the existing growing stock, the authors state that "though a mixed forest of oak and deodar will prove the most profitable the latter trees must never be permitted to exterminate the former; for the deodar alone can never cover the ground so effectually as when mixed with another tree; and, moreover, the leaves of conifers do not produce so plentiful and rich a mould as those of broad-leaved trees." The *Pinus longifolia* tracts were at the time pure except where oak existed in some cases; the growth of this latter should be encouraged, which would be possible by the exclusion of cattle.

An excellent description of each compartment is given in the Report. From the remarks made anent the rights and privileges of the villagers and others it is obvious that these were still in the position already detailed in previous pages of this history. The coming settlement would, it was hoped, define them, and the authors rightly insisted that the crux of the efficient management of the forest under their Report would lie in the rigid exclusion of grazing in the compartments prescribed to be closed and in the prohibition of lopping, cutting, litter-collection and other trespass.

No fellings had been undertaken in the Municipal Forests

since 1858-9, but up to that date the Municipality had cut within the tract all material required for fences, bridges and repairs. The forests in the Native States round Simla were, say the writers of the Report, "without doubt rapidly disappearing under the vast extension of potato cultivation and the increased demand for wood" (cf. I, 289). "Consequently the annual yield from a forest of 2000 acres will always be easily disposed of in Simla, and, as the timber imported has to be brought from greater distances, the price of wood must increase." There were more than 360 European residences in Simla at the time, and Wild had estimated the daily consumption of fuel at 500 maunds for residents and 900 maunds for the breweries (cf. I, 477). Green firewood was then selling in Simla at the rate of 3 maunds per rupee. The authors estimated the average annual out-turn from the thinnings and cleanings prescribed for the next five years at 10,000 maunds, which there should be no difficulty in disposing of at the rate of Rs.25 per 100 maunds. They recommended, as the most practical way of disposing of the fuel, that the timber should be felled, cut into lengths and split into convenient sizes, carried to the nearest main road, stacked in lots and auctioned there as quickly as possible. With regard to poles and logs capable of yielding sawn timber, the Municipality would require all the latter and probably most of the former for municipal works. The sale of surplus deodar poles would be easily effected.

The sylvicultural system to be employed, for many obvious reasons, was the selection system combined with the cutting back of such young growth of *Andromeda*, *rhododendron*, etc., as might prove prejudicial to the development of young oak regeneration. The irregular nature of the growing stock, the preponderance of the younger-age classes and the undefined limits of the villages precluded the authors from drawing up a division of regular blocks to be felled over once during a definite period. They advocated cultural operations such as the restocking of blanks and the improvement by sowing and planting of the worst of the deteriorated blocks as, e.g. *Elysium*; the method suggested being mixed sowings, in pits, of deodar and *Pinus excelsa*. But this work could not be commenced till the grazing question was settled and the large numbers of cattle, sheep and goats in Simla were definitely restricted to prescribed areas. A tabular statement of the prescribed thinnings to be undertaken is included in the Report, these latter to be commenced on March 1st and completed in April. Some of

the prescriptions detailed are as useful to-day as they were then, e.g. no tree should be felled in proximity to a road, ornamental groups of trees such as the fine clump of deodars at Anandale "must not be interfered with on any account, and all places of public resort, sites for picnics, etc., should be respected."* It is noteworthy that present-day opinion in forestry circles in France is advocating this policy; and more especially the desirability of conserving groups, or even a whole compartment, of especially well-developed trees, when a mature forest is being cut over, in order to leave for the public of the future a demonstration of what the area is capable of producing under skilled management. From the point of view of propaganda and the education of the public in the possibilities which good forest conservancy is capable of achieving in a district, the sacrifice entailed by the pecuniary loss is more than counterbalanced by the educational results, and at times, the æsthetic results, achieved or maintained.

In their Report the authors made a necessary stipulation, based on the methods of managing communal forests in France and Germany. They suggested that, at any rate for the first year, an Officer of the Forest Department should be deputed for two months to mark the thinnings, the Municipal Officer in charge of the area being present to see how the work was done. They added the further suggestion for the consideration of the Punjab Government, that a Departmental Officer should be deputed annually to do the marking work—a wise proviso; for no Municipal Officer without professional training could be expected to carry out this delicate operation, which calls for the highest skill of the Forester. The authors undertook some trial experimental thinnings over a few acres to arrive at a figure of the cost of the work. As a result their estimate of the yearly net value of the out-turn in timber was Rs.2000 from the annual area of 100 acres to be felled over. The estimated revenue from grazing was Rs.1000. The staff proposed for the management of the area (instead of 1 Jemadar at Rs.10 and 5 Peons at Rs.6 each—total Rs.480 per annum) was 1 Forester at Rs.30, 2 Forest Guards at Rs.8 each and 3 do. at Rs.6 each—total, Rs.768 per annum.

With reference to the felling of trees on private estates (always so dangerous on steep mountain slopes unless carefully supervised; Simla and other Himalaya stations had suffered

* The Author noticed lopping taking place in woods on the road down to Anandale during his visit to Simla in May 1925.

severely from the practice) the authors wrote: "Permission should as a rule be refused to private individuals to fell trees on these estates. The compounds of houses are usually so grazed or worn by traffic that young growth is exceptional, and if people are allowed to remove their present growing stock the hill-sides will be bared without a chance of reproduction and ravines will inevitably be produced." They suggested that proprietors should only be allowed to fell trees on their estates after permission of the Municipal Forest Officer, and that the latter should previously mark the trees to be removed and suggest the method of felling and removal, which would have to be adhered to. The Report concludes with some interesting data on the subject of quarries, ravines and landslides, and equally valuable recommendations with reference to their management and treatment—recommendations which at the period passed unheeded.

THE PLAINS FORESTS

The settlement of the question of forming Fuel Reserves from the *rakh* areas in the Plains progressed but slowly. It will be remembered it had been engaging the attention of the Government in the late 'sixties (II, p. 283). In 1875-6 Baden-Powell, the Conservator, records some advance in his Annual Report. He draws attention to the importance of definitely determining the area to be kept as *rakh* Fuel Reserves and then undertaking a settlement of such areas in order to enable them to be placed under efficient management. Without such a plan he pointed out that forest growth on the *rakh* areas would disappear. The chief of these areas in the Plains were the *rakhs* in Rawalpindi, the Fuel Reserve North (in the Salt Range), Fuel Reserve Central, including areas near Lahore, Montgomery, Multan, Muzuffargarh, Dera Ghazi Khan, and the Reserve in Gujranwalla. Baden-Powell proposed that all the *rakhs* selected in the above localities should be created real Reserves, all other *rakh* areas to be given up. He suggested that the loss of revenue to the Department would be large and that therefore the revenue from the open *rakhs* should be credited to the Forest Department, the reserved *rakhs* being closed and left unworked till their growing stock had improved. As will be shown in a later part, with the development of irrigation in the Province, this *rakh* problem to some extent automatically settled itself owing to the large areas which came under cultivation. But considerable

trouble in their management was experienced before that. Even at this early stage of forestry development the true solution had been commenced by way of the irrigated plantations.

The Changa Manga Plantation.—Dr. Stewart, Conservator of the Punjab, had reported specially on the fuel question in the Plains. As an outcome of the decision to form plantations over some 20,000 acres, if success attended the first efforts, a programme was drawn up in May, 1866, and the services of Messrs. Birnie Browne and C. F. Amery were secured for the work. One of the areas taken up for the purpose was *Rakh Changa Manga*, 780 acres, of which 140 acres were sown that year with mixed seeds in trenches 15 feet apart—100 acres were successful. Difficulties were experienced at first, but these were gradually overcome. Pearson, officiating Inspector-General of Forests, in his Annual Review of Forest Administration, 1870-1, states that it had been realized that better results would be attained by concentration, than by dotting small plantations about the countryside. Changa Manga, situated about 44 miles from Lahore, on the Bari Doab Canal, from which it was irrigated, had proved the most successful at this time, some 4200 acres having been planted with *sissu*, *ber* (*Zizyphus Jujuba*), *kikar* and other species. The oldest trees were four years old. Ribbentrop was in charge at this period. Pearson says: "The most satisfactory feature in the plantation is the evenness of the results on a large area, which seems far preferable to any amount of premature development in a few scattered places. It is hoped to complete the present block to 7000 acres in the next two years." The outlay to 1870-1 had been something under a lakh of rupees. Pearson continued: "It is proposed to extend this plantation (if the water supply proves sufficient) to 15,000 acres, possibly 20,000 acres may be reached. From it the whole railway above, as far as Amritsar and the Beas, will be supplied, besides which it will afford large supplies of fuel for Lahore. In the North Punjab a fuel plantation is being established in Jhelum, in the south there are others near Ludhiana and Delhi. There is also a '*sailaba*' (alluvial) plantation of about 1200 acres along the Ravi River (Shahdera) near Lahore." By 1875-6 the plantations at Changa Manga were 8172 acres in extent. In his Annual Report for the year Baden-Powell, the Conservator, alludes to the fact, already noticed by Brandis, of "the natural growth of mulberry in the plantations . . . this growth

has appeared spontaneously in 'open places' in Changa Manga, Ludhiana and Phillour."

It was this easy development of the mulberry from seed largely distributed by birds and water which led to the mixed crops of *sisso* and mulberry. There were now two Circles in the plantation: first (Van Khara) of 6843 acres was a completely stocked forest of *sisso* with a slight admixture of mulberry and other species; the second Circle (Maujoki) was actually commenced in 1872. It was proposed to increase it to 4000 acres, but owing to the possible deficiency in water supplies, species not so dependant would be used. By 1876 there were 600 acres of four-year-old *sisso* and 960 acres of two-year-old *jhand* (*Prosopis*) in the Circle, and another 1000 acres had been trenched and sown. Thinnings were undertaken in this year in Blocks I of both Circles, 1st Compartments 6, 7 and 8; 2nd Compartments 77-III.

The plantation came into bearing in April, 1881, when Schlich reported that the total cost of its establishment (then 11,409 acres) amounted to Rs.3,70,848. The average out-turn of fellings in 1881-2 was 175 cubic feet per acre of fuel stacked. In 1884 a bullock tramway was purchased to facilitate the removal of the produce of the fellings. This tramway was only replaced some forty years later! A Revised Working Plan for the plantations was sanctioned in 1885-6 and finally approved in 1890-1. This plan was again revised in 1895-6.

In 1892 there were fifteen Forest Divisions in the Punjab, as follows: Kohat, Hazara, Rawalpindi, Chamba, Kangra, Bashahr, Jhelum, Chenab, Lahore, Multan, Montgomery, Umbala, Simla, Kulu and Hissar.

In his Annual Report for 1888-9 the Conservator reported that, owing to the paucity of officers, the Working Plans branch was in abeyance. Out of 6000 square miles of forest controlled by the Department only 364 square miles were under Working Plans. The Bashahr State Forests and those for Kulu were without plans. The Branch was reformed a year later, but in 1891-2 the Government of India still regarded the progress as unsatisfactory, only 5.4 per cent of the area being under plans. In the following year the Conservator pointed out in his Annual Report that a large area of forests in the Plains consisted of inferior woods and that the proportion under Working Plans should not be considered by area in the Punjab. The Government of India were unable to admit the plea and said that Divisional Officers should undertake the preparation of

plans for their own divisions, as was done in the North-West Provinces, Oudh and Bengal. "The time," they said, "has gone by when the preparation of Working Plans can lightly be considered as a labour to devolve mainly upon a special agency employed for that purpose." A somewhat startling and retrograde pronouncement, which does not appear to have elicited a remonstrance from the Inspector-General.

In 1895-6 Working Plans were under preparation for 1841 square miles. A plan for the Simla Catchment Area was completed and a plan for the Simla Municipal Forests was commenced.

The total area of forest under the control of the Department in 1899-1900 was as follows: Reserves, 2891 square miles (343 square miles of leased forests); Protected, 2473 square miles; Unclassed, 3837 square miles. Total, 9201 square miles or 8.30 per cent of the total area of the Province.

The revenue for 1899-1900 amounted to Rs.14,00,770 (quinquennial average for the preceding five years, Rs.11,39,510) and the surplus to Rs.1,89,310, the preceding five-year average being Rs.3,89,286.

Of the area of 9201 square miles controlled by the Department in 1899-1900 2504 square miles (including 6 square miles of the Simla Municipal and Catchment Area) were under sanctioned Working Plans, and plans for 128 square miles were sanctioned during the year. An area of 5172 square miles was still without Working Plans.

In view of developments to be recorded in a later part the following is worthy of record. In their review of the 1897-8 Punjab Annual Forest Report the Government of India remarked: "It appears that 9804 deodar trees and 629 pines and other trees were extracted during the year, as against 9564 deodar and 759 pines in the previous year, so that the trade in trees other than deodar is not increasing. Nor is it possible that it will do so until some means of rendering the wood of the various pines more durable and more fitted for railway sleepers becomes a practical possibility. The Conservator should be asked to consider the question and to bring it forward in his next report." The following year the Inspector-General's Review of Forest Administration contains the Conservator's reply. After referring to the efforts being made to increase the utilization of the pine forests, the Conservator remarks: "With regard to the impregnation of pine timber a separate Report has been furnished. It is impossible, with the present reduced

controlling staff, to launch out into new enterprises of such magnitude. If the Railway Management or private firms would undertake the establishment of one or more centrally placed factories the Forest Department and other private proprietors could easily supply timber enough to keep the factories going."

Up to a point the Conservator was right. But the initiative did not rest with him, but with the Inspector-General of Forests, as this history will clearly demonstrate.

BALUCHISTAN

The question of reserving forests in Baluchistan was only first given effect to in 1880-1. Eight square miles of District Forests were formed, the revenue and expenditure of the first five years averaging about Rs.9,774 and Rs.15,247, the second year only showing a surplus of Rs.934. The urgent need for providing at least for fuel supplies, however, made a surplus a secondary consideration. In his 1885-6 Review of Forest Administration the Inspector-General remarked: "A Forest Law for Baluchistan, providing for the constitution of permanent forest estates, received the sanction of the Government of India during the year; but as yet no forest areas have been reserved under its clauses, and the permanency of a supply of forest produce is no nearer than it was the day the Province was annexed." By 1888-9 the area of forest, now shown as "Unclassed State," had increased to 21 square miles, including two blocks of juniper (*Juniperus macropoda*) forest near Ziarat, a block of 9 square miles on the Zarghin and 5 square miles in the Pishin Plain, a few miles from Quetta. Proposals to take up further areas were given effect to in 1890-1, powers under the Act being used for the first time to constitute regular Reserves. At the close of the year 78 square miles were under the Department. Notifications under the Acts were also issued, reserving certain classes of trees and providing generally for the working of the regulations, which were apparently being introduced without causing friction between the Department and the people. In the following year the Thalli Reserve was constituted (25 square miles), the total area amounting to 106 square miles. The chief breaches of the Forest Law were due to illicit grazing, but the Deputy Conservator stated that the introduction of the new protective rules had been received by the country people with equanimity.

At this period the total out-turn of timber and fuel amounted to 537,172 cubic feet, of which only 4000 cubic feet was timber.

The extraction of fuel had largely increased. The receipts were Rs.19,030 and the expenditure Rs.55,620. A Deputy Conservator was in charge, and his salary would bulk largely in the charges which were increased that year owing to the transfer of the irrigated Shebo plantation from the Military to the Forest Department.

Between 1892-5 some 69 square miles were added to the forest area, 19 square miles being added to the juniper area under the Department. The other forests were at Kach Mangi (15 square miles), Zarghin (6 square miles), Mari Chak (3 square miles), Surghond (25 square miles) and Khushdilkhan (1 square mile); the total forest area now amounting to 175 square miles. The whole of this area was settled Reserved Forests. Plantation work had been undertaken, some of it without great success. During 1896-7 the plantations at Shibu and Khushdil, which had proved failures, were disforested, thus reducing the area of Reserves by 5 square miles. The acreage of regular plantations in 1900 amounted to thirty-three only.

The receipts and expenditure for the three years 1894-5 to 1896-7 were as follows: Rs.15,191, Rs.14,751, Rs.15,942 and Rs.44,548, Rs.36,382, Rs.28,478. The Agent to the Governor-General (Review on Forest Report) remarks: "The results of the year under report are better than was anticipated and reflect credit on the Forest Officer. The decrease in the deficits is encouraging." In the Zhob Valley an expenditure of Rs.980 was incurred on Forest Conservancy, whilst the revenue realized, almost entirely royalty on wood, amounted to Rs.4,142.

By the close of the century the area of Reserves amounted to 205 square miles, and further reservation projects were under consideration but were deferred owing to scarcity and famine, which afflicted Western India at the time. The revenue for 1899-1900 was Rs.17,060 and the deficit to Rs.11,620. The out-turn of timber was 12,705 cubic feet, and of firewood 450,012 cubic feet. In this connection the Agent to the Governor-General wrote: "The drain on the Baluchistan Forests for firewood continues to present a very serious problem. The Reports for the past few years clearly show that natural and artificial reproduction cannot be reckoned upon to meet the large consumption, and this seems to be chiefly due to the fact that only the trees which thrive naturally in the inhospitable climate of Baluchistan are of extremely slow growth. The drain is especially marked in the unclassified forests, and, as shown in the Report under review, the local supply

at the present rate of consumption can only be expected to last for a few years. The best method to prevent its total exhaustion appears to be to restrict the local cuttings and import firewood from the Sind Forests, from which, according to the Deputy Conservator's estimates, it can be landed in Quetta at an accessible rate."

CHAPTER VII

PROGRESS OF FOREST ADMINISTRATION IN THE NORTH-WEST PROVINCES AND OUDH, 1871-1900

THE NORTH-WEST PROVINCES

IN the detailed account of the introduction of forest conservancy into the North-West Provinces (now called the United Provinces), given in previous chapters (II, Chaps. VIII, IX), it was shown that the Authorities of the Province were slow to recognize the necessity of placing this branch of administration on a proper basis. The neighbouring Province of Oudh, then separate from the North-West Provinces, had reached a far higher degree of organization by 1871 (Chap. x).

In Volume II (pp. 283, 309) the plans being undertaken to supply sleepers for the new railway construction taking place in Northern India were discussed. This work was well in hand at the beginning of the period here reviewed. The following extract from the Inspector-General's (Pearson was officiating) Review of Forest Administration, 1870-71, is of interest: "The Rajputana Railway now under construction, which will run from Delhi and Agra to the Sambhar Lake, draws its principal supply of sleepers from the North-West deodar forests. Its total length, as at present sanctioned, is about 400 miles, for which 800,000 sleepers are ordered; of this number 120,000 are required at Delhi, and the remainder at Agra; about 84,000 have been already delivered at Delhi, and 150,000 more are lying sawn up in the Tons Forests ready to be floated down in the spring, when the melting of the snow has filled the river. Timber for 200,000 more from the Bhagiratti Forests is now in the Dun, which will be sawn up, and the sleepers sent to Agra during the present cold weather . . . the Forest Department expect to deliver 300,000 sleepers (half coming from the Tons Forests, and the other half from the Bhagiratti) in 1872-3. The balance, or about 125,000, will probably be supplied from the sâl forests of Kumaun and Garhwal, where 80,000 sleepers are now being cut for this season's supply.

In former volumes allusion has been made to the Bhagiratti Forests on the east side of the Ganges in Tehri-Garhwal State, which had been leased from the Raja (I, 503-504 ; II, 299). In order to open out these forests a road was commenced up the Bhagiratti Valley by O'Callaghan (II, 306, 312). These forests were surveyed by Grant in 1869, Pearson having visited them the previous year (II, 333-335). In 1869-70 the road construction was under a Public Works Engineer, but the Department subsequently took over charge and the credit for the great success achieved is due to Greig, who was responsible, both as Deputy Conservator and Conservator, for the great development in exploitation facilities introduced in this valley and in Jaunsar. The construction of the Bhagiratti road was a gigantic task, involving the erection of suspension bridges, one of which, over the Byramghati, had a span of 450 feet suspended 450 feet above the river. This road provided an easy passage to the flocks of pilgrims who annually travelled up to visit the Gaumukh, one of the most sacred spots in India. Eardley Wilmot, who was subsequently in charge, says the deodar forests were very fine. "I remember having a deodar felled which yielded, with wasteful conversion, 400 narrow gauge sleepers." On the expiry of the first period of the lease the Raja refused to include the Bhagiratti Forest and road in the renewed lease. The construction of the road had interfered to some extent with the lucrative business the hillmen had made out of the pilgrims in assisting them up the rude mountain paths and precipices in the pre-road times !

In order to extract the sleepers from the Jaunsar Forests an elaborate system of slides was being constructed and in the Conservator's (G. Greig) Annual Report for 1871-2 a description of this work is given which is worth quoting. These slides and sledge-way were the first thing of the kind ever built on this scale in India, and were larger than European examples of a similar type. Captain Lillingston was in charge for a short time before his death, due to his pony slipping from the road whilst on the way from Deoban to the Tons. Greig wrote : "The Tons deodar sleeper works are going on well ; 7486 10-foot sleepers were delivered at Delhi during the year, and 14,321 6-foot sleepers at Agra. . . . In the Dartmeor Forest 17,404 logs were cut, and rolled either into or close to the river. In the Lambertach Forest 128,000 sleepers have been sawn, of which 20,000 have been carried to and stacked at the head of the slide, and 25,000 at the head of the tramway. The tramway

(sledge-way), which is a little over 1 mile in length, is in working order, and sleepers are being taken along it daily ; but the slide was not quite finished. This slide is 6300 feet long, almost perfectly straight, from 10 to 11 inches broad, and has a gradient of from 1 in 7 to 1 in 10. It will shoot the sleepers into the Pabur River, about 3 miles above its junction with the Tons. In the Mundhole Forest there are 120,000 sleepers sawn, of which 70,000 have been carried to spots convenient to the head of the canal (wet) slide. This slide differs considerably from the Lambertach one ; it runs down a water-course, crossing and recrossing according to the features of the banks, and is 4 miles and 250 feet long. It is of a much more easy gradient, varying from 1 in 5 to 1 in 100, and a good flow of water, supplied by means of wooden troughs leading from the stream, is always kept running down it. The original design was the late Captain Lillingston's idea : he had intended to construct the slide entirely of blocks of deodar of such a size as to be hereafter convertible into two narrow-gauge sleepers." Lillingston's idea did not work in practice, firstly, because the slide was too broad and jams occurred and, secondly, because since the bottom was made of two pieces of wood the slide leaked so badly that it quickly dried, resulting in heavy breakage of sleepers. About half a mile had been constructed on this plan by Lillingston and a short piece added after his death. The rest, however, was constructed with scantlings of *Pinus longifolia*, 14 feet by 12 inches by 5 inches, specially sawn on the spot, there being plenty of trees on the slopes. The more dangerous parts of the upper length were relaid. Greig continues : "The whole slide was laid down by the end of April. During May and June we had many experimental trials, and each one showed us some defect, and it was not actually put into real working order until the end of June. . . . From the foot of the slide to the bank above the river, a wooden tramway 2 feet gauge and 1½ miles in length has been constructed along a plateau which is not of sufficient downward slope for a slide. The tramway terminates at a precipitous bank 800 feet above the Tons River. From the top of this bank a wooden trough has been made, which shoots the sleepers right into the Tons. The trough is constructed of the same sized timbers and on the same principle as the canal slide, but the joints had to be more securely fastened."

Owing to the steepness of the incline of the Lambertach slide it gave considerable trouble. Eventually the sides were

cut down and the top boarded in after which it worked admirably.

This method of extracting sleepers from these hills persisted through the period dealt with here and the work formed one of the "show" sights in this part of the Himalaya. The actual Tons sleepers work referred to above came to an end in 1874-5, when all work in the *forest* for the railway contract was completed, although many of the sleepers then being prepared would not reach the railway before 1875-6. The sleepers put into the Tons River floated down to the Dun, where they were caught by a boom and made into rafts for their further journey (*vide* II, Plates facing pp. 520, 524). Up to 31st March, 1874, from the commencement, 396,219 sleepers of different sizes had been cut in these forests and delivered to the Railway, and 89,120 remained in stock; the price realized was Rs.9,88,180. The expenditure came to about Rs.7,69,209, leaving a balance in favour of the works of Rs.2,18,970.

These sleeper works were subsequently resumed in this region, and the excess deodar growing stock removed under the lease in parts of Tehri Garhwal throughout the remainder of the century.

The Chakrata Barracks were being built in 1870-71 and deodar scantlings and spruce bullees (poles) were being supplied, also *Pinus longifolia* timber. The officers of the 55th Regiment were also building houses and a sum was outstanding against them which, says an Annual Report, "will be paid when they receive from Government the advance promised to enable them to build."

Between December, 1874, and March, 1875, Brandis carried out an inspection of the forests of the North-West Provinces and a more detailed visit was made by him in the early months of 1881. There were then three Circles—the Oudh, Central and School Circles, the two latter in the North-West Provinces. At the close of the 1881 inspection Brandis drew up a voluminous Report, entitled "Suggestions regarding Forest Administration in the North-West Provinces and Oudh (1882)," in which he included the results of the 1874-5 visit. The observations and suggestions in this Report having reference to Oudh will be alluded to in the next chapter.

In the Province under consideration Brandis marched, in 1881, through some of the forests in the Terai District, under Mr. J. C. Macdonald, and then joined Mr. G. Greig, Conservator

of the Central Circle. With him he examined the Kumaun Forests, meeting Sir Henry Ramsay, who was still Commissioner of Kumaun (*vide* II, p. 325). Brandis then marched through Garhwal, seeing the Patli Dun and Kotri Dun Forests (II, Chap. IX) and entered the recently formed Ganges Division, which comprised the submontane forests of the Garhwal District near the Ganges as well as the Chandi Forest in the Bijnor District. On crossing the Ganges to Hardwar, Brandis was met by Schlich, Conservator of Forests of the Punjab, and by Major F. Bailey, R.E., the Director of the Forest School, Dehra Dun. An inspection was made of the Patri Forest, south of Hardwar, the outer Siwalik Forests (Saharanpur District) and the Dehra Dun Forests. After a stay at Dehra the party proceeded to Chakrata in the Himalaya and visited the hill forests of the Jaunsar and Tons Divisions, arriving at Roru in the Pabar Valley in the middle of May, nearly four months after the start in Oudh. In his "Suggestions" Brandis gives a clear picture of the position of the forests and their administration at this period.

It will be remembered that in 1868-9 Pearson, the first Conservator of Forests in the North-West Provinces, had made a detailed inspection of the forests. Brandis classified these forests into two classes—the forests on the higher hills of the Himalaya in the Jaunsar and Tons Divisions and the submontane and Siwalik Forests. The hill forests included those on the Tons River and its affluents, the forests on the Jumna and Bhagiratti Rivers in the Tehri State and the forests in the vicinity of the stations of Ranikhet and Naini Tal. The object of undertaking the systematic management of these hill forests was, says Brandis, twofold. To provide a permanent supply of timber, chiefly deodar, to the plains (which was floated down the Ganges and Jumna Rivers) and to furnish a permanent supply of timber and firewood to the stations of Chakrata, Ranikhet and Naini Tal. There was also the further object of providing for a permanent supply of wood and other forest produce to the agricultural population in the vicinity of the forests, although at that period, owing to the scanty population in the hills, this object was of secondary importance. For export to the plains deodar was the only wood for which there was a steady and large demand on the above-mentioned rivers. The demand for *Pinus longifolia*, although increasing, was limited. The local demands of the three hill stations mentioned were provided for by a large

variety of woods, those of chief importance being deodar, spruce, silver fir, *P. longifolia* and the three oaks (*Quercus incana*, *dilatata* and *semecarpifolia*). The sylvicultural study of all these species was of very great importance. To the extensive submontane and Siwalik Forests (under the Forest Department) Brandis added the forests of the Terai District of the Kumaun Division. These forests were not under the Forest Department and had not been notified as Reserves under the Act. Brandis said that they had been demarcated and were sufficiently protected, which may have been true at the time, but was not so subsequently. They then consisted of the eight blocks: Makonia, Kilauli, Sarapu, Kukrala, Dimri, Kilpuri, Debipura and Biheri, total area 141 square miles. Brandis also mentioned the Iron Company's grant, now estimated at 205 square miles, but alluded to by Pearson as "about 400 square miles" (II, p. 323). This grant separated the two great subdivisions of the Kumaun Forest Belt, the Eastern and Western Divisions. Most of the timber from the Western Kumaun Forests was taken to Ramnagar, where the Department had a depot, that from Eastern Kumaun went to Pilibhit and Bareilly. In his Report Brandis deals with suggestions for the future organization, fellings, etc., of the forests of the Province, which were divided into the Kumaun, Garhwal and Ganges Divisions of the Central Circle, and the Saharanpur, Jaunsar and Tons Divisions of the School Circle. The other Divisions of the Province were the Jhansi, Lalitpur, Naini Tal and Ranikhet.

The Kumaun Forests.—It was proposed to divide the Kumaun Forests into three Working Circles under a Working Plan regulating the felling of sâl only, the other associated species being of less importance. In Eastern Kumaun two Working Circles were to be formed—one comprising the hills drained by the Nindhaur and Kalauni Rivers and the other by the forests outside the hills; the third Working Circle would be formed by the forests of Western Kumaun.

A valuation survey of the forests on the hills drained by the Nindhaur River was commenced in January, 1881, under the charge of Mr. E. P. Dansey, Assistant Conservator. The survey of eleven blocks in the lower or western portion of the valley had been completed, two of which were excluded from the valuation. The forests of this Working Circle measured about 300 square miles, of which one-half (96,000 acres) were considered to be workable; of this area 13,089 acres had been

enumerated, yielding 18,572 first-class sâl trees (over 6 feet) and 39,451 second-class trees (4 feet 6 inches to 6 feet), giving an estimated number of trees in the Circle—first-class, 60,000 ; second-class, 120,000. It was admitted that nothing was known about the rate of growth of sâl, all attempts to determine the age by counting the annual rings having failed. Sample plots were selected with the object of obtaining this essential information. As was his invariable practice, Brandis framed his estimates for future fellings on the safe side. It was considered that the market could be kept fully supplied by felling an annual amount of 50,000 cubic feet of sâl timber from these forests and that the latter could easily and safely supply this amount. He dealt in detail with the areas, and methods of selection and felling, the necessity for adequate fire protection, which was considered essential, and of undertaking valuation surveys in all areas of fully or over-stocked forests.

Dansey's method of undertaking his valuation surveys, based on experience gained in Jaunsar and the Patli Dun, although now well known, merits a description, since, according to Brandis, this young officer appears to have devised a procedure which was subsequently widely followed.

"The valuation has been made by dividing the area into plots according to natural features, chiefly ridges. Eighty-three plots have been formed in the total area of 13,089 acres, so that each plot averages about 157 acres. The examination has been effected in the following manner. Nine survey parties are employed, each consisting of one Recorder and four Measurers. The party proceeds from the river to the upper limit of the plot along one boundary, the boundary trees having been marked. Each Measurer is provided with an axe, with which he marks each tree measured by him on the bark, and a calliper on which the diameters of the different classes are indicated by colours. The size classes used are as follows: Diameter of 24 inches and upwards—green; diameter of 18 inches and 24 inches—yellow; diameter of 12 inches and 18 inches—black; diameter of 6 inches and 12 inches—red. The Measurers call out the colour of each class, which is noted by the Recorder according to the system of notation used by Forest Officers in France. . . . The work of the parties is checked in the following manner. The counting of the plot selected for check is repeated by the party which had been engaged on its survey, under the personal superintendence of the officer responsible for the survey, who is expected to complete the counting himself."

The forests outside the hills which were to form the second

Working Circle consisted of ten blocks : (1) Horai, (2) Chorgalia (3) to (6) the large extent of forest between the Dewa (Nindhaur) and Kalauni Rivers, and four blocks in the east of Kalauni, (7) Goliapani, (8) Barmdao ; (9) Sarda and (10) Chandni. It would have to be decided in the future whether the north boundary of the blocks near the hills (1 to 6 and 8) should run along the foot of the hills or should follow the line of watershed of the outer range. Brandis' description of the well-known Horai and Chorgalia blocks as they were in 1881 is as follows : " Horai (6000 acres). The fire protection of the portion north-east of the Sitarganj-Haldwani road has been attempted with varying success since 1877. A great part of this forest is covered with high grass and scattered groups of poles, and a few large hollow trees. Successful fire protection will change the character of this forest, and until this has been accomplished, no trees of any kind should be cut in it. The forest extends to the boundary of the Terai District, but the southern part, near the Terai boundary, is not at present under the control of the Forest Department. Here the ground is undulating with numerous streams and springs, and the growth of *sâl* in this portion, which has been excluded from the Reserve, is excellent.

Chorgalia (2000 acres). This is an almost pure forest of *sâl* poles and young trees, and is in many parts completely stocked. It is grazed over and burnt every year, but as there is scarcely any grass the fires do very little harm. Nevertheless, I am of opinion that the growth will improve considerably by fire protection, and I would therefore recommend that the eastern portion, which is well stocked, should be closed entirely. . . . On both the lower and upper portions, half-acre sample plots have been marked off, on which all trees should be measured periodically, twice a year—once in the beginning of December and once in the beginning of May. I do not recommend that any cuttings should be made at present. It is possible that when fire protection has been firmly established thinnings may be made, but this operation had better be deferred for the present."

It was not considered possible to cut any large quantities of *sâl* from these two blocks for some time to come, and Brandis laid down that in any event no trees should be felled in any areas not fire protected. He suggested that the blocks should be divided into suitable compartments by an Officer of the Working Plans Branch in consultation with the Divisional

Officer, and that one compartment should be taken in hand annually and any sâl trees to be cut in it be marked by a responsible officer, a summary description of the compartment being drawn up at the time with suggestions regarding its future treatment. The local Officers were desirous that any timber felled in these forests should be felled and extracted by purchasers and not by Government agency, a change in management which was becoming eminently desirable if the Forest Officer was to be afforded the time to make a commencement with his more legitimate duties of studying the sylviculture of his trees and so forth.

The forests of Western Kumaun were divided into three ranges—the Garhi Bulchand, Chilkia and West Kotah. The Garhi Bulchand had an area of about 11,000 acres and was stocked with a good forest of sâl poles except on stretches of dry, high ground and where the forest was open. It was divided into ten compartments and had mostly been fire protected since 1876, though the greater part was burnt in 1878. The Chilkia Forest had an area of 80,500 acres and the West Kotah 35,200 acres. Six blocks of these forests had been fire protected: the Mohan, Dungargarh, Dulwa and Melani (total area, 49,000 acres) in Chilkia and Kosi, and Sitabani (total area, 33,500 acres) in West Kotah. These two forests had been divided into sixty-five and thirty-seven compartments respectively, the boundaries being either natural paths or fire-lines. Portions of these forests were protected from fire before 1875, but in the hot season of 1874 they were mostly burnt. Since 1875 success had been gradually attained. The plan followed by Major J. E. Campbell, the Divisional Officer, which he cautiously developed, had been to maintain a system of cleared lines along which ran footpaths, practicable for walking and, in most cases, riding. Owing to the irregular configuration straight lines were not practicable. Campbell established a network of paths 3 feet to 4 feet wide, which were built up with dry walls where necessary. Along these paths, lines usually 50 feet wide, were completely cleared of all trees, etc., and the lines were burnt every year. Great success had been attained by the method which became a general one not only in this Province but in others. In commenting on the results achieved here Brandis wrote: "Since the system has been in force in a perfect manner very few important fires have occurred, and meanwhile the young growth of sâl and other trees has, where the circumstances were otherwise favourable

made such wonderful progress that, unless any unusual accident occurs, the protection of the forest may be regarded as assured." Brandis was very much struck with the changed appearance of these forests since his inspections in 1863 and 1875, from areas of burnt grass and smouldering tops of felled trees, presenting a black and desolate appearance, to the existing condition of green thickets of young sâl growth, which in itself rendered the protection of the forest easier.

Between the years 1868-9 to 1880-1 a total of 25,079 trees measuring 487,279 cubic feet had been extracted from the Chilkia Forest, and 8180 trees measuring 196,458 cubic feet from the West Kotah Forest. The material was brought out in both log and scantling (mostly *harris*) form. Most of these fellings had been undertaken in forests not previously touched. Some of the areas, such as the Durgadeh Forest, were stocked with magnificent trees. This latter was heavily cut between 1870-3, and a second cutting was undertaken in 1880-1. In 1882 no forest was left in Western Kumaun, which had not been subject to fellings, nor, says Brandis, "is there any area which contains sufficient timber to justify Government timber operations on a scale similar to those hitherto undertaken. But in most of the forests visited by me on the present occasion it will be possible, without in any way endangering reproduction, to make a second cutting, and this will greatly benefit the development of the young growth. It will, however, be necessary to arrange these second cuttings in a very methodical manner, and always to keep in mind that the chief aim must be to secure the regeneration of the forest by means of a complete growth of young sâl." Ramnagar, where Government had an excellent depot to which merchants from Meerut and even from the Punjab resorted, was the outlet for the sâl timber from this area, and it was estimated that from the available workable sâl forest, amounting to 70,000 acres occupied with growth of all ages including trees of 6 feet and over, it would be possible to make an annual cut of 30,000 cubic feet, which could be increased tenfold without any danger. He then deals exhaustively with the plan of cuttings in the various areas, descriptive work of compartments to be carried out, works of improvement such as climber cutting, etc., and states that the planting of sâl on a large scale is not here called for. The Inspector-General alludes to the experimental sowings of sâl and other trees which had been made on grassy blanks in West Kotah. The plan pursued was to plough and

sow a crop of grain, and, after cutting the crop, to plough in lines 15 feet apart, throwing up ridges along the lines. Unfortunately the supply of sâl seed proved deficient in 1879 and 1880, so that the ridges were only sparingly sown and, to a great extent, with other seeds. The result was that the plants in the lines were scattered and it had been necessary to protect them with hoods of grass against frost and the sun of the hot weather. Whilst Brandis considered the sowing in lines to be correct, he advocated sowing a belt of sâl seed at least 12 inches to 18 inches wide along the lines.

An excellent system of cart-roads existed in the area, constructed to facilitate timber extraction in the past; many of these were permanent or easily repairable when their use was again called for. This road system also assisted the collection of revenue from the minor forest produce, which was still carried on under the Kham Tahsil system (II, p. 325). An urgent want was, however, the provision of suitable rest-houses to shelter the staff. Had Brandis' recommendations on this subject been made widely known in other parts of India at this period, the close of the century would not have found the conditions in this respect as deplorable as was the case (*vide* Vol. II, p. 522). To Captain Wood, Conservator in Oudh, belongs the credit of having devised and started the erection of the excellent system of rest houses in existence in these two Provinces. These rest houses were divided into three classes: first-class: two rooms in the upper story, cost Rs.3500; second-class: one room in the upper story, cost Rs.2,600; third-class: ground floor only, cost Rs.550. It was proposed to build one first-class house at Ramnagar, three second-class at Mohan, Leti and Kalu Shahid, and ten third-class elsewhere. In the Eastern Kumaun one first-class at Chorgalia, two second-class at Barmdeo and Dandaki Toti, and twelve third-class elsewhere.

Garhwal Sub-montane Forests.—It will be remembered that Pearson reported (1868) on the forests of Garhwal and said that, though some parts had been worked, enormous tracts of virgin forest still remained (II, 317). Fire protection had been extended to parts of the forests with varying results, a first attempt having been made in the South Patli Dun by Mr. R. Thompson, Assistant Conservator, as early as 1864. The chief efforts in this direction were only begun, however, in the late seventies. By 1881 this division had been divided into the following ranges: Rehar, South Patli Dun, North Patli

Dun, Sona Nadi, Dharon, Palain and Kotri Dun. It was proposed to introduce efficient fire protection into the Rehar, South and North Patli Dun and the Shisham Khata tract of the Sona Nadi range, and when this protection was firmly established the other ranges would be taken in hand. The area to be protected would be about 70,000 acres out of a total of 175,000 acres. Between 1871-2 and 1880-1 some 11,000 sâl trees had been felled in Garhwal, mainly by Government agency. The trees had been mostly converted into scantlings.

The chief Range of importance from the revenue point of view was the North Patli Dun, the forests being situated on numerous feeders of the Ramganga River. Owing to the difficulties facing extraction they had been scarcely worked at all. In 1877 it was decided to make a regular valuation survey in order to prepare a Working Plan, since they were, with a few exceptions, the only ones in Garhwal in which any large quantities of mature sâl timber remained, and where, therefore, considerable fellings could be undertaken. Dansey was employed during the open seasons of 1877-8, 1878-9 and part of 1879-80 in carrying out this survey, in dividing the area into compartments and in drafting the outlines of a Working Plan. It will be impossible to follow either Dansey or Brandis through their interesting Reports. Brandis reduced Dansey's suggested annual yield for the forests to 50,000 cubic feet, saying that until fire protection was thoroughly introduced, and in the absence of definite knowledge as to the rate of growth of sâl, great caution should be evinced in felling operations, even in as rich an area as the North Patli Dun.

Amongst minor produce the bamboo (*Dendrocalamus strictus*) formed one of the most important items of export from Garhwal. The bamboo forests were very extensive, but there was good ground for believing that they were being overcut, although the Conservator, Greig, did not appear to share the opinion. Brandis considered that the bamboos extracted in 1863 were larger and of a finer quality than those he saw in 1875, and during 1881 he noted a further deterioration. There was also a decrease in quantity. For the five years ending with 1875-6 the quantity exported averaged 1,000,000 scores, while during the succeeding five years it was only 650,000 scores. Brandis contended that the bamboo clumps were being overcut, that sufficient of the older culms were not left and that in their absence the plant had not, as a rule, sufficient strength to produce a crop of full-sized young stems. Whilst young

bamboos were necessary for certain purposes such as mat and basket-making, for building purposes they were less durable than the older stems. He therefore recommended that, as an experiment, part of the North Patli Dun range should be closed to bamboo cutting. The total receipts from the old Garhwal Division (which included the recently formed Ganges Division) had increased for the three years ending 1880-81 from Rs.1,32,000 to Rs.1,70,000. The two last points considered were the utilization of the grass lands and the erection of rest houses. On the subject of the former it was considered that their improvement must be deferred until fire protection had been extended over all the really valuable portions of the Division. Brandis thought that some of these areas could be planted with *khair* and *sissoo*, whilst others could be given out on short leases for cultivation, and eventually that forest villages could be established in them. As regards rest houses, a first-class one was to be built at Dhikala, a second-class one at Kalagarh and six third-class ones elsewhere.

Ganges Division.—This Division had been recently formed out of the old Garhwal Division. It comprised the leased Bhagiratti Forests of the Tehri State, 90,560 acres at the foot of the hills in Garhwal, and the Chandi Forest, area 20,882 acres, in the Bijnor District. The boundary between the Garhwal and the Ganges Division was the valley of the Koh River, near Kotdwara.

The Chandi Forest occupies an outlying stretch of hills of the outer Siwalik formation. In 1867 this forest had been made over to the Rurki Engineering College Workshops for the supply of timber, fuel and charcoal. It was stipulated that neither wood nor charcoal should be sold, but this ruling did not apply to minor produce. By 1881 all the forest on the lower levels had been cut out, with the result that all the lower portions of the Chandi Hills, to which the cuttings had extended, were bare. As fire protection had never been introduced these areas were now mostly covered with grass. Stumps and coppice shoots, however, existed, and it was thought that the protection of these areas from fire would lead to a considerable portion being restocked with trees and brushwood, though Brandis was of opinion that, except in a few cases, no large timber could ever be expected. The tops of the hills which were uncut contained the original forest, principally consisting of *Buchanania latifolia*, *Anogeissus latifolia*, with a varying proportion of *sâl*. The Conservator having reported that the

forest was being destroyed, it was transferred to the Forest Department in 1880, but no record was obtainable as to the amounts of timber, etc., which had been taken out of it by Rurki during their management. The ruin to which a forest can be subjected by this type of ignorant exploitation is well exemplified by the condition of the Chandi Forest in 1881. But even Chandi had not been so heavily worked as the neighbouring hills across the Ganges River above Hardwar, which, being more accessible, had been denuded for local requirements. The introduction of efficient fire protection was considered to be the first step to be taken in Chandi. Perhaps the main item in the yield from the Division at the time was the supply of wood to the Canal Works. The wood was used for the construction of the temporary head-works, for which none but straight poles from 10 to 30 feet in length could be employed, but any kind of wood could be utilized. Once fire protection had been introduced it was considered that the forest should be able to easily supply the amounts required, which fluctuated between 5000 and 20,000 pieces a year. Each piece was a young tree and only well-grown poles were utilizable. The felling of such poles, the best in the forest, was not, as Brandis pointed out, in accordance with rational forestry, but the large area could be counted to produce the required amounts if properly selected and extracted. It was doubtful, however, whether the price charged in the Ganges Division for this material was sufficient, especially as it was less than that charged in the Dehra Dun Division on the other side of the Ganges; and, moreover, at the existing rates it would prove more profitable to allow the trees to attain a larger size. The Canal Officers were contemplating taking large amounts from the Ganges Division owing to the smaller price, and, as Brandis said, it was high time that the two Conservators concerned should arrange upon a common price and no longer compete the one against the other. Since the demand from the Division was increasing, the two urgent requirements were efficient fire protection and the preparation of a Working Plan to prevent overcutting.

The forests on the west bank of the Ganges at Hardwar were under the Conservator of the School Circle, Colonel F. Bailey, R.E., subsequently Lecturer in Forestry at the University of Edinburgh. The inspection of these forests was undertaken conjointly by Brandis and Schlich, Conservator of Forests in the Punjab, who had been appointed by the Government of

India Members of a Board of Inspection for the purpose. The forests in question comprised those of the Saharanpur and Dehra Dun Divisions in the plains and the Jaunsar and Tons Divisions in the Himalaya.

The Saharanpur Division.—This Division covered an area of 190,696 acres and comprised the forests on the southern slopes of the Siwaliks and in the eastern half of the plains immediately below the hills. It was divided into the Western, Central and Eastern Ranges. It has been already shown that Pearson (II, p. 330) had not a great opinion of the value of these forests. The chief recommendations made by the Inspecting Officers had reference to fire protection. Some attempts, more or less unsuccessful, had been made in this direction within the few years preceding 1881, but the main efforts had still to be undertaken, and the Report deals with the lines, now well known, upon which the work should be envisaged. The fellings in the hills had been so heavy that denudation had set in and the *raus* (streams) had become much enlarged, threatening to a serious extent the cultivated ground in the plains, whilst the water supplies were seriously diminishing. That the prescriptions with reference to the laying out of a properly connected series of fire lines and fire-traced roads were made on a sound basis is evidenced by Ribbentrop's Report on an inspection he made of a part of this area in company with Sir Thomas Holderness, at the time Revenue Secretary to the Government of India, in 1899 (*vide* II, p. 558). One illustration, a most striking one, will furnish sufficient evidence of the value of the recommendations made at this period by Brandis and Schlich. The following is an extract from their Report: "The protection of the Ratman Basin against fire, if continued sufficiently long, will have a most beneficial effect in improving the character of the Ratman Nadi stream and preventing injury to the Ganges Canal. It may be reasonably expected that the current in this stream, which, under existing circumstances, comes down in occasional sudden floods during the monsoon, will be more uniform if the sides of the hills become more completely clothed with forests, and that the present monsoon current will gradually be converted into a steadily flowing stream. . . . An essential point in this arrangement is that in order to increase the cover and to make protection of the soil more efficient, no green timber whatsoever should be cut in any part of the Ratman Basin during the first years of fire conservancy." When pointing out to Sir T. Holderness (in 1899) the

results attained by protection in this area, where many channels, surveyed and mapped as late as 1876, had now ceased to exist, being overgrown by bushes and young sâl reproduction, Ribbentrop, alluding to the Ratman basin, says: "the sides and slopes of the hills were clothed with grass and young seedlings, and the water no longer rushed down, carrying silt with it."

Some experimental sowings of *khair* (*Acacia Catechu*) on 25 acres had been undertaken in the Central Range during the rains of 1879-80. The seed was sown in lines on land covered with 3 to 5-foot-high grass. The lines were either ploughed or hoed. A fair proportion of the plants were alive, but it was held that the seed had not been sown thick enough. The grass had protected the plants from sun and frost, but had tended to make them lanky. As *khair* was indigenous in the area it was recommended that this instructive experiment should be continued by yearly additions. The Conservator also proposed sowing sâl seed in patches arranged in lines, the end of the lines being marked by a pile of stones. It was also suggested that a contiguous plot should be planted with sâl seedlings dug up from the forests—a plan which, it was said, had succeeded well at the southern end of the Buxa Reserve in Bengal (*vide* p. 198 *infra*).

The chief forest of the Eastern Range was the Patri Forest, lying to the south of Hardwar, consisting of five blocks (II, p. 330). No protection either from fire or grazing had been yet afforded to this forest. Mr. A. Campbell had commenced a plantation at Ferozepur about the year 1871, the area being protected against fire. The plantation, about 80 acres in extent, was irrigated from the Ganges Canal. A large variety of seeds were sown but only *sissu* succeeded on any large scale, and even this tree showed very slow growth. The seed was sown in trenches 5 feet to 6 feet apart. It was suggested that as *khair* was indigenous it should be tried here, the seed in future being sown more thickly in the trenches; it was hoped that three years' watering would suffice. To improve the Patri Forest the first step to be taken was efficient fire protection.

An area of 1000 acres east of the Rani Rau consisting of bamboo forest had been successfully protected against fire and cutting for three years. The condition of the clumps afforded hope that this protection would result in better and more numerous bamboos being obtained from the clumps. Experiments

had also been undertaken by partially cutting over a number of clumps with the object of seeing whether better and more numerous young shoots would be obtained.

Excluding Patri, the Saharanpur Forests had been divided into thirty-nine blocks, both for administrative and revenue purposes. Several adjoining blocks had been combined into a beat, there being nine beats in the Western, nine beats in the Central and six beats in the Eastern Range. In some blocks (as recommended by Brandis in his Report of 1878) the revenue on dry fuel, bamboos, grass and minor forest produce was leased to contractors, whilst in others the revenue was collected departmentally. For the extraction of bamboos a regular rotation had been established, some blocks being closed whilst others were open—the first instance of the introduction of such a method for bamboos in India. The felling of green timber had been very irregular, permits being issued to fell certain amounts with no restriction as to size of tree or number cut out, the permit only stipulating the amount and time in which the material was to be extracted. In future it was laid down that all trees to be felled should be previously marked by a responsible officer and, until fire protection was efficient, it was desirable to limit the felling of green trees so far as possible. Grazing dues were collected by the village Revenue Officers under the Collector. In order to enable the Guards to check the number of animals a system of tickets had lately been established. It was suggested that suitable work could be found for the students of the Forest School in making periodical measurements of the growth of sâl, plantation work in Patri and Lakarkot, and in the examination of mature timber in the hill blocks.

The Dehra Dun Forests.—The forests of this Division are situated on the northern side of the Siwalik Range and in the Dun plateau, and were divided into the Western, Central, Eastern Dun and Eastern Siwalik Ranges (54,000, 48,000, 33,000 and 42,000 acres respectively). Of this total area 27,664 acres were closed to grazing and protected against fire, the remainder, 150,115 acres, being open and usually burnt annually. The introduction of efficient fire protection in the Central Range was considered most important. This was first commenced in the Bulawala Forests in 1872 and had been gradually extended over the entire Siwalik slopes of this Range. The following is a typical example, from the Report, of the fire protection proposals for the whole of this Siwalik ergion,

though it has particular reference to the Central Range here under consideration :

" The protection against fire is secured by burning the grass and forest outside the lower edge of the closed area, and towards the Siwalik Hills in the Bulawala Forests, by burning the forest outside a 200-foot line which was cleared about ten years ago (i.e. in 1871). In the forest west of Bulawala the line towards the hills is a cleared road 10 feet wide, not cut straight through the forest, but following the configuration of the ground so as to be useful as a bridle-path. The forest above the road towards the hills is burnt annually so far as is practicable. Regarding these exterior lines in the protected portions of the Central Range, we desire to submit the following suggestions. Along the lower edge there are large extents of grass lands within the closed area, which are at present a source of considerable danger, especially in the portion west of Assarori, where villages adjoin the forests. In some cases these grass lands will gradually get stocked with forest growth, if we succeed in protecting them continuously against fire, but in others they are not on ground suitable for the growth of *sâl*. The risk from fire might be diminished, either by burning the grass entirely off them, or by isolating the plots by means of fire traces between them and the forests. . . . As regards the inner lines towards the hills, we are disposed to advocate the adoption throughout of the plan followed west of Bulawala. The upper bridle-road which follows the old elephant track may, with great advantage, be continued eastwards as far as the Jhabrawala boundary line ; and if the forest outside this path is burnt there ought to be no risk on that side. It is intended eventually to include the whole Siwalik Range at the head of the Ratman basin within the fire-protected area down to the upper boundary of the Bulawala Forest : this plan has, however, not yet been carried out. The inner and outer fire lines are joined by a number of more or less parallel lines, 10 feet wide, which have been laid so as to follow the configuration of the ground and to serve as export lines. A cart-road has also been made from Assarori to Bulawala, so as to facilitate the export of timber by the Mohan road. In the Bulawala Forest there was originally a system of straight lines at right angles to one another, one of which, the horizontal line known as the Colvin line, is still maintained ; but experience has shown the great difficulty in keeping these lines clear, as they do not follow the configuration of the ground and are never used for traffic. The line known as Colvin's line will probably have to be maintained with a less width, but the straight transverse lines should be abandoned, and in their place a number of export roads, following the configuration of the ground, should be cleared. . . . In the *sâl* forests of Oudh, where the system of roads through the forests has been developed with greater success

than in any other Province, experience has shown 15 feet to be the most convenient width of roads which are to serve as fire-lines and for export of produce ; and it has also been found that the maintenance of these roads is greatly facilitated by digging drains on the sides, and by forming a slightly raised road in the middle." It was admitted that in broken hilly ground the construction of such roads would not always prove feasible, but where the terrain was suitable the adoption of the plan was advocated.

Thinnings in these forests had been commenced in 1876. In 1878 Brandis had expressed himself as not altogether satisfied with the work, and his examination of the area of 1920 acres in 1881 confirmed his apprehensions. The ground was covered with grass, very few seedlings were present and the coppice shoots were frosted and in many cases attacked by a black fungus ; and yet the forest had been protected from fire. At first sight, he says, the thinned compartments presented a regular and neat appearance, but on closer examination they were found to be exceedingly unpromising and unsatisfactory (cf. II, 332). The girdling recommended by Brandis himself had not proved satisfactory as the trees were badly infested by insects and he recommended that the practice be discontinued. It was decided to stop the thinnings in the Bulawala Forest, " where the soil is poor, sandy and full of boulders," and start them on both sides of Assarori, where the soil was more binding, richer and moister. The operations were to proceed compartment by compartment. It is not, perhaps, surprising that thinning operations were disappointing in view of the fact that nothing was known of the habits and requirements of the *sâl* at the time. Experience had to be bought in the light of failures.

In regard to the open forests it was considered impracticable to extend fire protection to them at the time, but it was thought desirable to extend the road system through them in order to prepare for their future protection from fire and also to stimulate the export of dry wood and of such green timber as it might be possible to cut. A good commencement in this respect had already been made by the construction of a fair-weather cart-road through the Lachiwala Forest, from Bulawala to the Hardwar-Dehra road. The thinnings proposed in the forests on either side of Assarori would be exported by the Mohan road. It was desirable to stimulate the export of timber by other lines also. Of these the most important were considered to be the Jumna River, the Timli Pass road, the Khansrao Pass and

the Hardwar road; there would be plenty of material to export from the existing large area of forest.

At this period there was a very considerable export of timber, chiefly in the form of *karris* and scantlings, from private forests in the Dun. Two private forests to the west of the Government Forest of Ambari were visited; one of 5000 acres was leased for timber-cutting purposes to a Saharanpur merchant for seven years for a sum of Rs.17,000; the other, of 2500 acres, under the same conditions for a sum of Rs.11,000. During the preceding five years the export of timber from private forests in the Dun had largely increased; and Brandis evidently viewed this destruction of the private forests with complacency as a stimulation to the establishment of timber operations in the Dun to supply the Saharanpur markets and so dispose of the necessity of felling in the Government Forests on the southern face of the Siwaliks

In the case of the grazing grounds he advised their selection solely with the view of protecting the better class of forests, his idea having always been to protect the latter at the expense of the former. Here he advocated, where possible, the separation of the grazing lands from the protected forests and making fellings in the former. He says: "Under these circumstances the question arises how these cuttings should be arranged with the least possible injury to the permanent interest of the forests; and this can, in our opinion, only be solved by making the cuttings in those areas which it is not intended to maintain permanently as forests." Ribbentrop, a few years later as Inspector-General of Forests, it may be considered justifiably, contravened this theory, saying that no fellings of green timber should be made in areas of unprotected forests, until they had been protected from fire—for with a growing population the sacrifice of such areas by wanton destruction or over-felling was unjustifiable.

There were some sample plots in the Bulawala Forest, but they were not very suitable, and others of 1 acre each were selected in 1881 in the Phandowala and Lachiwala blocks. In these suppressed and badly shaped trees were to be thinned out and the plots were then to be measured twice a year. This and other work was scheduled as suitable for the School students, as also a study of the *sissu* and *khair* forests along the Song River and elsewhere in the Division, little being known about the silviculture of these species.

The Jaunsar Forests.—These are situated in the Himalaya

and were discussed together with the forests on the Tons River in Pearson's Report of 1868-9, as already described in Volume II, pages 335-46. The forests of what was known in 1881 as the Jaunsar Division had been divided into three ranges, each range into a number of forests, and each forest into a number of blocks. The ranges were : the Southern, a small one consisting of two strips of second-class forest along the Tons and Jumna Rivers and three deodar forests in the Jumna Valley ; the Deoban, area 35,400 acres, comprising the Lokandi, Deoban, Ekra, Karamba and Konain Forests, and the Bawar, of 33,000 acres, including the forests in the Riknar, Dharagadh and Dharmigadh, and those on the Tons near Bastil. The Deoban Range consisted of 2200 acres of the first-class Reserves of Bodyar, Kanesar and Konain, the remainder being second-class Reserves, 5423 acres of which were closed to grazing and fire protected. The Bawar Range comprised 2968 acres of first-class Reserves : Tutwa, Lakhau, Kathian and Koti ; the remainder being second-class Reserves, of which about 5100 acres were protected against cattle and fire and 3400 acres against fire only. In addition, the Division included the Forest Garden at Chakrata as well as two blocks, area 500 acres, within cantonment boundaries which had been handed over to the Department. The establishment consisted of only three Foresters and eighteen Forest Guards, the idea being that Probationers and Apprentices from the Forest School were to be employed from time to time in charge of the more important ranges or forests where instructive work was being undertaken—a plan from which little success could be looked for. The newly trained assistant requires to go to school when he commences his life's work in the forest and learn from experienced officers ; to place him in charge without such guidance is to spell disaster.

The chief operations laid down in 1881 by the Inspecting Officers were connected with regeneration and planting work. Their Report on this head is most instructive and, although it is impossible to do more than summarize it here, it is well worth perusal. Plantings of a more or less desultory kind and with varying success had been carried out from 1873 onwards ; during the rains of the latter year Mr. Whittall had planted in the Mohna block a large extent of grassy slopes in the Rangai, Katban and Agar basins. The *kharshu* oak (*Q. semecarpifolia*) was the species used, and success was attained, the plants varying from 2 to 3 feet in 1881. About the same time a large

number of spruce were raised in nurseries and planted out in 1876, a considerable number 2 to 3 feet in height being seen in 1881. Generally speaking, the success achieved had been poor, especially with deodar, and it was suggested that blue pine, which was seen to be self-sown on blank slopes, should in future be used as a nurse for spruce and oak on areas exposed to the sun (which it could withstand).

Fellings had been made in this block between 1875 and 1877, the block having been protected since 1871. The object of these fellings, which had been successfully performed by Bagshawe and Dansey, had been to let in sufficient light for the development of young growth whilst leaving an adequate number of trees for protection and seed. The fellings yielded about 356,000 cubic feet. They had not met with the success hoped for as but little regeneration had followed them, the young growth on the ground consisting of the advance growth, fortunately abundant in parts, which had been there previously. The conclusions formed from the inspection were that the two oaks, *moru* and *kharshu* (*Q. dilatata* and *semecarpifolia*) germinated readily on the rather dense humus layer whilst the seedlings from the lighter seed of the pines failed to reach the mineral soil and so dried up. "Clearly," says the Report, "some other arrangement of cuttings must be made in order to ensure the natural reproduction of these forests," and wounding the soil to provide germinating beds was one of the methods prescribed for the future. Deodar was also proving a difficult subject to deal with. Plantations on blank grassy slopes failed to thrive and in fact so far the success chiefly met with with this species was on moist northerly aspects at the lower elevations, such as, e.g. Kanesar and Kathian, whilst at Bodyar considerable difficulties had been met with. The experimental work carried out at this period was invaluable. Practically nothing was known upon the silvicultural requirements of the species being dealt with and it was only through trial and reverses that success could ultimately be hoped for.

The planting, sowing and felling work laid down for the five years 1881-2 to 1885-6 was to be carried out in the following forests: Lokandi Forest, where the planting up of the Bodyar first-class Reserve was to be completed and considerable fellings made; Deoban Forest—planting up of Matkangra, with the land in cantonments (Lurli Block, 150 acres, to be

sown and planted with *chir* and deodar); planting up of the blanks and slopes, 300 acres, in Mohna and suggested fellings in Mohna and Thona which (with the preparation of the soil for natural regeneration) would require careful supervision; Ekra Forest—fellings in Hajawa; and Dharagadh Forest—protection and working of the rich deodar forests of Maura and Lakhau, and arrangements for the carriage of the timber to the Tons.

The following interesting measurements show the height and dimensions of the trees in the Maura Block:

Aspect, westerly; altitude, 8000 feet.

		Height	Girth.	
		in feet.	Feet.	Inches.
Deodar	. .	162	—	—
"	. .	144	6	2
"	. .	158	8	6
"	. .	127	7	4
"	. .	167	11	0
Altitude 8400 feet.				
Silver fir	. .	151*	—	—
"	. .	183†	13	—
Spruce	. .	200	25	4
"	. .	146	14	8
"	. .	146	14	8
"	. .	147	14	8

Experiments had been made with coppicing the *kharshu* oak, so far without success, and it was recommended that these should be carried out to ascertain the coppicing powers of all three oaks, *moru*, *ban* and *kharshu*. It might never prove advantageous to grow these oaks as coppice, but, on the other hand, it was thought possible that oak coppice might be found to be exceedingly useful as a nurse to raise a young growth of silver fir, spruce and deodar.

Up here in these hill forests there was plenty of work for the activities and education of the Forest School pupils, and amongst other items of importance was the necessity of carrying out investigations into the rate of growth of the different species. The inception or organization of the Forest School has already been discussed (II, 505). It will be obvious from the description of the available work in the plains and hill forests here described, that the situation of the School, with its large

* Gentle slope.

† Deep soil.

area of attached forests managed under the direction of the Director, was ideal for the training of a subordinate staff.

The Chakrata Fuel Supply. Chakrata was a military cantonment situated at some 2500 feet below and south of Deoban Hill (II, 335). In 1878 it was estimated that the annual consumption of firewood was 200,000 cubic feet of solid wood. Owing to the fact that the station had not been occupied for the whole of the year this estimate proved in excess of the amount actually consumed, the average being less than half. The average for the previous ten years amounted to 142,408 solid cubic feet, however, the material being oak and fir. It was considered advisable to leave the future estimate of the requirements at 200,000 cubic feet solid. The area within a moderate distance of Chakrata from which this supply could be obtained amounted to 5423 acres, which were protected from fire and grazing. In addition, another 12,000 acres reasonably close existed, protected against fire but not against grazing, with another 5800 acres in the valleys at lower levels which was grazed and burnt over annually. The most valuable part of the total area was the first named. It was situated in twelve blocks, e.g. Bodyar, Kanesar, Konain, Thona, Kanjatra, etc. Of these only about 2000 acres were first-class forest and under strict protection. As regards the rest, it was suggested that it might be necessary to effect exchanges. In this respect the authors of the Report give the rather dubious advice that "in making such exchanges, the aim should be, as much as possible, to open to pasture lands situated at high elevations, where the growth is slow and the reproduction more uncertain and difficult than at lower levels. Moreover, there is more demand for high-level grazing on the part of the surrounding villages than for pasture at lower levels." These may have been the opinions held at the time, and certainly were in parts of Europe, but almost irremediable damage resulted from putting into practice this theory. In some parts of the Pyrenees French Forest Officers are at the present day engaged in endeavouring to counteract the resultant damage due to "the opening in the past to pasture areas of forest *where the growth is slow and the reproduction, moreover, uncertain and difficult.*" Slips, washouts, avalanches and gullies started above have resulted in great havoc and loss to the very forests lower down which it was the object to protect by sending the excess grazing animals to the upper levels.

It was decided that the 5400 acres of forest (only 3000 acres of which were stocked) would not be able to provide the total supply of fuel required, and that a considerable portion of this amount would have to be drawn from the 12,000 acres protected against fire but not against grazing, of which only about one-third was stocked—thus giving a total area of 7000 acres from which to obtain the fuel supplies. This was considered sufficient, and the Report

laid down a five-year cutting scheme under which the fellings which, for sylvicultural reasons, were to be made in the Mohna, Haiawa, Thona and Bodyar blocks, would suffice to supply the amount of wood fuel required. One of these prescribed fellings was a heavy felling in the *kharshu* oak on Snowy View, east of Deoban Hill. The charcoal required by the station was mostly supplied from private forests near Ambari (in the Dun) and from the Government forests near Kalsi (on the Jumna), being brought up by carts from the low-level forests.

As regards the deodar timber demanded by Chakrata, under the existing arrangement the amounts required were brought from Konain, and it was laid down that this plan should be continued "unless it should be found expedient to cut deodar in Bodyar or to cut the old trees in Kanesar, an operation which will probably be very beneficial in promoting the development of younger trees."

The Tons Forest Division. This Division was a very mixed one at the time, consisting of the Kunigadh *chir* (*P. longifolia*) forest on the left bank of the Tons River, the Drogas Forest in Jaunsar, the Dadi and Raiengarh Forests in British Territory, under the control of the Punjab Government (leased from the Jaghirdars), the forests of the Tons River, leased from the Tehri-Garhwal State (II, pp. 256, 257) and the forest on the Pabar, leased from Bashahr, the latter being under the control of the Punjab Government. No Ranges had as yet been formed, but the forests were divided into the following protective charges in 1881:

1. Deogar Forest, including Mandhol, with Dadi and Raiengarh—in charge of a Forester.
2. Deota, with Bamsu, Surars, and Datmir; also the *chir* forests both in British and native territory on the left bank of the Tons—in charge of a Forester.
3. The Lambatach and Kotigadh Forests—a Forester.
4. The leased forests of the Pabar and Rupin Rivers in Bashahr—in charge of two Forest Guards.

It will be seen that not much progress in conservancy had been yet made in this area. Pearson had visited and reported on the forests of this region in 1869 (II, pp. 341-6), and a proportion of the sleepers required for the Rajputana Railway then being built was obtained from this area. The Lambatach and Deota Forests had an area of 2063 and 5087 acres respectively, of which 1800 and 2500 acres were estimated as deodar-bearing in 1871. Fellings had been undertaken in Lambatach in 1871, the total number of trees cut in all blocks being 3600. In Deota fellings had been carried on till 1878 in the Partil and Temple blocks, 3897 dry trees and 2067 green trees having been cut, whilst 750 trees had been prepared for felling in each of the years 1879-80 and 1880-1. An interesting point about these fellings was that the quality of

timber required annually for export was obtained from a smaller number of trees than were marked for felling, nearly 1000 trees being on hand unfelled, mostly in the Dopta block, which was to be closed to felling. In Katatach, on the other hand, fellings had only just commenced and it was not possible in 1881 to estimate how many trees this block would yield during this first felling.

After an examination of the forests the Inspecting Officers laid down the principles on which future fellings and regeneration work were to be carried out. In the Deota block two types of forest were present—pure deodar and mixed deodar. The former occupied the more precipitous ground and the easier south and south-easterly slopes. In these forests the future fellings were to be limited to areas where young growth, which was abundant and increasing, was present. These fellings should, however, be limited, as the forests were incompletely stocked with mature trees, and should not be made in ravines where there was danger of snow-slides. In the mixed forest the deodar was associated with spruce and silver fir, or with *moru* and *kharshu* oaks. The management of this class of forest was recognized, from attempts already made, to be difficult. It was considered that efficient treatment would depend upon the extent to which iron-making could be developed so as to convert the wood of the other species into charcoal. As long as this was not possible the only alternative was to girdle the inferior species, and it was suggested that this should be done a considerable time before fellings were undertaken in the deodar, only the larger trees and a proportion of the poles being thus girdled; and this only in forests which contained a sufficient proportion of deodar. Pure forests of oak, spruce and silver fir would have to be left untouched for the present until a demand arose for the timber of these species. Thus, after the fellings in Katatach were completed, Jaurasi, Kanga and Patangni would be taken in hand. It was impossible to estimate at that time the yield of these blocks, but it was laid down that the annual yield of deodar from this division estimated in 1878, i.e. a total of from 50,000 to 60,000 cubic feet of timber, should not be exceeded. As regards natural regeneration and cultural work in Deota, the former was generally satisfactory in the Partil block, particularly good results following the heavy deodar seed year of 1878. In the Temple block the conditions were not so satisfactory and some cultural operations would be necessary.

No more fellings were to be undertaken in Lambatach. Deodar reproduction was here far from good. In 1878 attention had been drawn to the extensive thickets of young blue pine of from five to twelve years of age in Lohasu, Chakora, Garasna and Thanwar. Thinnings had been proposed, but had not yet been commenced. It was laid down that these thinnings should be systematically carried out with the object of freeing all deodar which were found amongst the blue pine. In the rest of Lambatach the only young

deodar consisted of advance growth which was in existence before the fellings were made. Even extensive girdling of spruce and silver fir in some areas had not been followed by the springing up of deodar, as had been hoped. As Lambatach had been protected from fire and grazing since 1873 it was obvious that assistance would have to be given to obtain a new crop of deodar.

A third description of land existed, consisting of extensive grassy slopes similar to those already described under Jaunsar, on which no seedlings were present. Cultural operations, to assist deodar, were prescribed dealing with three classes of localities—moist ravines in which the spruce had been killed by ringing; drier slopes stocked with *Indigofera*, and the extensive grassy blanks. Generally, these operations were to be undertaken as follows: In planting hill-sides covered with undergrowth the plants were to be planted in groups in large cleared patches; whereas, on the bare grassy slopes the plants were to be put into pits dug in horizontal lines 10 to 15 feet apart, the pits being 3 to 5 feet apart in the lines. The plants would either be raised from seed in nurseries or taken from areas of young natural regeneration elsewhere and either used direct or lined out in temporary nurseries, a method Moir, the Officer in charge here, had commenced. As regards sowing the plan of vertical lines was recommended, each line consisting of separate patches at a distance of about 4 to 5 feet from each other.

The *Pinus longifolia* forests on the Tons River from Hanol to Kunigadh had been protected from fire and grazing since 1878, and the other forests of this species near the Tons as far as Gaichran had been examined and reported on. A quantity of this timber had been exported from here, on Government account, in 1871, but no later fellings had been made. Some offers for the timber had been received, and it was decided that fellings should for the present only be made in the unprotected forests, and that there would be no objection to extensive fellings being made, if necessary, owing to the very large area of this type of forest. The effect of closure on the protected areas should be carefully watched.

It was stated that the principle work in the Division would for some time to come be limited to arrangements for the carriage of timber and the cultivation of the deodar. A suggestion was made that it was desirable, by way of experiment, "that wire rope tramways and tramways with timber carts be used, and that the system of temporary slides be perfected."

Lastly, there were the Bashahr leased forests on the Pabar and Rupin Rivers (I, p. 406; II, p. 344). These were placed under the North-West Provinces Government in 1869; but the first action for their control and management was not taken till August, 1880, when two Forest Guards were appointed. Since the population in this region was scanty it was not thought necessary at this time to

introduce any measures of protection for these forests, the people being allowed to take all they required for their own use, except deodar. The work of importance which should be taken up was the demarcation of all the more valuable forests, which would then be closed, especially to the shifting cultivation (Korali) practised unchecked in these areas by the people.

These forests being so distant from Dehra Dun it was not considered at this time that they would be of much value to the students for instructional purposes, and as they were closed in the winter season—15th December to 15th March—Brandis suggested that the Officer in charge of the Division should be deputed, during this period, to pay annual visits of inspection to the Reserves in Ajmére, then attached to the School Circle.

In 1889-90 the revenue for the Province amounted to Rs.17,14,159 as against Rs.14,62,802 in 1888-9. Expenditure was Rs.9,63,151 as against Rs.8,44,544 in the preceding year. The surplus was Rs.7,51,008. Both gross receipts and surplus of all the three Circles was higher than ever known before. Although the expenditure had increased in the past few years the receipts had risen more rapidly. Ribbentrop (in Review of Forest Administration, 1889-1900) drew attention to the fact that the expenditure on improvements had not kept pace with the rise in receipts. In the previous year's Review he had pointed out that in European countries the amount paid into the Treasury seldom exceeded 50 per cent of the profits derived from the State Forests, the balance being spent in maintaining them or in permanent improvements which go to enhance their capital value. For the preceding ten years on an average only 32 per cent of the real gross revenue had been expended on maintenance and improvement of the forests of India.

In 1899-1900 the revenue of the Province was Rs.16,14,740 (the average of the preceding five years having been Rs.15,31,824) and the surplus Rs.6,72,360, the preceding five-yearly average having been Rs.5,96,746. Even less was being spent on maintenance than was the case a decade earlier !

The history of the progress of Working Plans in this Province (including Oudh) is worthy of a brief analysis. In 1884-5 the North-West Provinces (as also Burma and the Punjab) had organized a special Division for the preparation of Working Plans, but at first progress was slow. In this year plans were being prepared for Naini Tal and Ranikhet. Also an elaborate plan for the Dun. Plans for the Kheri and Gorakhpur

Forests were under consideration ; and the following year for the Ganges Division and the Tehri-Garhwal leased forests. In 1896-7 the Naini Tal, Ranikhet, Ganges and Dehra Dun plans were sanctioned. In 1888-9, in his Review of Forest Administration, the Inspector-General remarks, as follows, anent Working Plans : " Much remains to be done. In the Oudh Circle no Working Plans are as yet in force, although the area controlled by the Department amounts to 1203 square miles. In the Central Circle 352 square miles are managed under plans, out of a total area of 1178 square miles. In the School Circle Working Plans have been prepared for 399 square miles out of 815 square miles and no new work appears to have been undertaken during the year under notice. The Working Plans in force are, as a rule, drawn up for short periods only, and, unless the work of preparing plans for the remaining forests is pushed on, it will not be completed before the existing plans call for revision or replacement." In 1890-1 the Inspector-General of Forests drew the attention of the North-West Provinces Government to the unsatisfactory state of the Working Plans of the Province. Several of the existing plans were unsatisfactory and their provisions too complicated, and serious deviations had also taken place in completing plans in hand. These remarks resulted in a renaissance in Working-Plan activity. This is commented upon in the 1892-3 Review. Marked progress had taken place in all Circles and simpler plans were under preparation throughout the Province. New plans were in hand for the Lansdowne, Kumaun, Garhwal and Saharanpur Divisions, whilst the Kheri plan received sanction. In his Review for 1893-4 the Inspector-General remarked : " The progress secured (in W. Plans) warrants the anticipation that within a short time the exploitation of all the more valuable forests managed by the Department will have been brought under the management of sanctioned Working Plans. Both as regards the quantity and quality of the work done during recent years the administration may fairly take the leading place amongst the Forest Departments of the various Provinces, not even excluding Burma." Plans had been completed for 1044 square miles in all Circles, plans were under preparation for 1125 square miles and only 680 square miles had not been brought under systematic working. In 1895-6 it was recorded that the Province still led in this respect, and in the following year it was stated that nearly all the forests in the Province were under sanctioned Working

Plans. There remained only 619 square miles to be dealt with, chiefly in Bundelkhand (for which no plan was required), and in Jaunsar and Gonda, for which plans were to be prepared.

In 1899-1900, out of a total forest area of 4122 square miles under the Department (Reserves, 4049 square miles, leased forest, 152 ; protected, 30 ; unclassified, 43) 3443 square miles were managed under Working Plans at the commencement of the year and a plan was sanctioned during the year for 5 square miles. Working Plans were under preparation for 222 square miles, leaving an area of 452 square miles for which plans had still to be taken in hand.

A very satisfactory record for the close of the century.

CHAPTER VIII

PROGRESS OF FOREST ADMINISTRATION IN THE NORTH-WEST PROVINCES AND OUDH, 1871-1900 (*cont.*)

CONSERVANCY IN OUDH

FOREST Conservancy in Oudh, when compared to many other parts of India, or even the adjoining North-West Provinces, had made considerable progress by 1870, as has been described in Chapter X of Volume II. It will be remembered that the chapter was closed with a vividly drawn word picture of the position of these forests by Eardley Wilmot, who joined the service in Oudh in December, 1873. A good commencement had been made and the revenue was fairly satisfactory in some districts. Fire protection was still, however, in its infancy and forest settlements were giving trouble (*vide* II, pp. 358-60). Even in Oudh, where there existed few "rights" over large tracts of the forests, the settlement of some areas was incorrectly made and forests were burdened with rights which under the law did not exist.

The position of the Oudh Forests and administration was the subject of an interesting Report by Ribbentrop, Inspector-General of Forests, in 1886, based on an inspection of the Oudh Forest Circle as it then was, the Province having been amalgamated with the North-West Provinces, with two Conservators, one in the North-West Provinces Circle and the second in Oudh. Ribbentrop alludes to a visit of Brandis to Oudh in 1881, which will be detailed later on, and to some work undertaken by Schlich in the forests. So that Oudh had had the benefit of the advice of three experts who had followed each other as Inspectors-General of Forests. During his visit Brandis, in his forecast of November, 1881, had fixed the annual out-turn in sâl to be cut in the Kheri Forests at 2500 sâl trees, to be extracted under selection fellings. A large demand for timber and sleepers subsequently arose, however, in consequence of the construc-

tion of the Rohilkland and Kumaun, the Bengal North-Western and of several Provincial State Railways (II, 368). Some of the State Reserves, and more especially those of the Kheri Division, being favourably situated, were called upon to meet the requirements, and heavy fellings took place in the Kheri Forests, largely in excess of the annual out-turn laid down by Brandis. The protection of the forests was also regarded as far from satisfactory, extensive fires having occurred in April and May, 1883, which spread over nearly half the area whose protection had been attempted. For these reasons, and more especially to decide whether the Kheri Forests were being overcut, it was ordered that the preliminary enquiries and enumerations necessary for framing a Working Plan for the Kheri Forests should be begun without delay, and Ribbentrop was instructed to proceed to Oudh, where he spent a part of March and April, 1886.

Before dealing with the main points at issue, Ribbentrop has some interesting remarks upon the configuration, soils and silvicultural requirements of the *sâl* and one or two other species of the Oudh Forests which may be briefly epitomized.

It will be remembered that after the Gurkha War of 1814-16, as a politic concession, a part of the fine Terai *sâl* forests was restored to the Gurkhas as they attached a great value to these forests (I, p. 193), a value of which we did not realize the full significance for many long years thereafter. Those forests were mostly in the North-West Provinces. In 1860, however, we ceded to Nepal a considerable area of the most valuable Oudh Forests, situated in the Terai (I, p. 509). The Himalaya in this region rise more abruptly from the plains, without the distinctive features of intervening Siwaliks and Duns which is characteristic of the areas to the west (Dehra Dun). Wherever the Terai approaches the hill ranges directly, and without intervening Siwaliks, a very extensive and more or less continuous belt of magnificent deciduous forests underlies the hills. These forests are generally known as the Nepal Terai. It was the bulk of these which the British restored to Nepal after the war. The Motipur and Kheri Forests, which are British, formed the outer fringe of the compact forest area of Nepal and were the most valuable forests of Oudh.

The area of Government Forests in 1886 was as follows: *sâl* forests, 586 square miles; miscellaneous forests, 89 square miles; *khair*, and *sissu*, 245 square miles; and grass lands

(*phantas*), 212 square miles. Total, 1132 square miles (cf. II, 357). The division between the *sâl* forest and miscellaneous forest was not always as abrupt as that between the *khair* and *sâl* forest. Ribbentrop pointed out that the above area totals presented a too-favourable picture of the actual contents of the forests, since the *khair* and *sissu* forests included a considerable extent (probably 50 per cent or more) of swamps and grounds exposed to annual floods, and which consequently could produce nothing but grass; and even those portions of the low-lying land which were capable of growing *khair* and *sissu* forest, and where numerous stumps and remnants of dead trees proved that a forest once existed, were as a rule mere grass plains, interspersed with more or less compact plots or belts of forest growth, studded here and there with single trees, which escaped the general annual fires which swept over the area. The *sâl* forests in the trans-Sarda localities, especially those forming the Kasumba and Dudua blocks, also contained large *phantas*, or low-lying open patches of ground, on which water collected in the rains, and which consequently could produce nothing but reeds and grass, and those in the cis-Sarda tracts including large areas, amounting, perhaps, to a moiety of the forests which produced at the time nothing better than an annually dying crop of *sâl* scrub.

The Government Forests of the Oudh Circle consisted of the Reserves in the Pilibhit and Gorakhpur Districts belonging to the North-West Provinces and the Reserves in the Kheri, Bahraich and Gonda Districts in Oudh. All these forests were constituted Reserves under Section 39 of the Indian Forest Act of 1878 (Notifs. Nos. 193 to 198, dated February 28th, 1879). At the time of the British occupation, almost without exception, these areas were unoccupied waste, situated outside the then existing village boundaries, and were beyond dispute State property. That this was so is proved by the fact that Government had transferred complete proprietary rights over areas made over to grantees or cultivators. In the North-West Provinces, but not in Oudh, conditions were attached to such transfers and grants by which the right in spontaneous forest growth was reserved to Government, and under which the utilization of such forest produce to which people had been accustomed was permitted. Such conditions were, however, naturally extinguished when the land came under the plough or was sold out and out (II, pp. 358-60). Under subsequent settlements this clear right was not maintained and it will be

necessary to glance at the procedure adopted in forming the Reserves.

In *Pilibhit* the Government Forest was formed by taking up the waste lands belonging to the State. As elsewhere in India the local population had been accustomed to make use of parts of this waste for pasturage and other forest produce, but payment was thought to have been collected by the Collector and had certainly been made since the forests had been demarcated. When the forest was notified as a Reserve (in 1879) the Local Government was not satisfied that the rights of the people had been sufficiently enquired into and recorded, and it was decided that a Settlement under the Forest Act should be undertaken by the Collector of Pilibhit. Under the Settlement, which received sanction, forty-four villages were entered as right-holders, in so far as they should have the right to have their wants supplied at current rates before the demands of outsiders were considered. The rights were admitted as having arisen by prescription, a decision which was legally incorrect—since a prescriptive right over a forest cannot be acquired by continuous purchase of its produce from the owner at market rates. The Forest Settlement Officer had, therefore, burdened the Reserve with legal obligations which were not in existence previous to the Settlement. The area of this Reserve contained 47 square miles classed as *sâl* forests, but even with the Settlement it was not clear at the time how much of this area was burdened by the rights. The other Reserve in Pilibhit District was the Puranpur Reserve (area 105 square miles). Some of the areas in this Reserve had formerly, in order to encourage cultivation, been given out as grants, but were resumed as the grantees had failed to fulfil the conditions. The mere fact that this procedure had been adopted indicated that no "rights" on the forests existed. But here, too, rights were admitted as in the case of the Pilibhit Reserve, and not less than 270 villagers were recorded as right-holders entitled to free grazing and to the following produce free of charge for their own requirements: wood for ridge poles, roofing and thatching, ploughs, sugar-mills, fences, fuel and grass for thatching, and fibres for ropes. Moreover, it was subsequently discovered that many of the villagers thus declared right-holders over the Government Forest had extensive forest lands of their own. The rules also permitted the burning (to obtain new grass) over two-thirds of the Reserve, but luckily this could be stopped by notification.

The *Gorakhpur* Reserves, consisting of sâl forests, were Government waste lands which, without any preliminaries, were formed into State Forests. The grass-lands in this district were divided into grants and were placed under the control of the Civil Authorities to be given out for cultivation. This measure did not meet with success, and about 1884 these areas, aggregating 26,827 acres, were made over to the Forest Department. The total area of Reserves in this district in 1886 was 102 square miles of sâl forests and 55 square miles of grass-lands—total, 157 square miles. A considerable number of grants, into which the Gorakhpur Forests were originally divided, were taken up, but were not cultivated to the amount demanded by the grant. They were not resumed, however, and Government had even ruled (G.O. No. 675, dated 27th May, 1885) "that there is no objection to the grantees keeping as much of their land under forest as they please, except where clearance is considered necessary for sanitary purposes." The Commissioner of the Benares Division held the opinion in 1886 that should Government wish to alter their policy it would not be debarred from resuming these grants unless the original conditions of the grants were carried out. The Commissioner appeared to think that, owing to the great increase in the value of property in this region, the area stipulated in the grant would be brought under cultivation. Ribbentrop was evidently doubtful as to whether this policy was the correct one to follow—whether, in fact, it was not desirable, in the interests of such a developing community, to include all the forest possible on these forfeited grants in the Reserves.

In Oudh the *Bhira Forest Reserve* in the Kheri District (Bhira Sub-division) had been through much the same experience, the grants having been resumed by Government. These latter and all ungranted areas were, between 1870–75, formed into a Government forest which was reserved in 1879. The forests contained within the Kheri trans-Sarda Reserved Forests had always been Government land, the sâl forests being demarcated and surveyed in 1861–2 (I, p. 510). The low-lying forest and grass-lands, including the Sumerpur Forest, were divided into grants, but were never disposed of, and were added to the State Forests in 1867–8, and the whole notified as Reserved Forests in 1879. These Kheri Reserves totalled 263 square miles: 150 square miles sâl forest, 20 square miles *khair* and *sissu*, 13 square miles miscellaneous and 80 square miles grass-lands.

The Forest Reserves in the *Bahraich District* were, with the exception of the Charda Forest, formed direct by taking up Government waste lands. A large part of the Charda Forest was held in grant (II, p. 358) by the Maharaja of Balrampur for six years, but was resumed as the proportion stipulated in the lease had not been cultivated. The Bahraich Forests totalled in 1886 325 square miles: 197 square miles *sâl*, 101 square miles *khair* and *sissu*, 27 square miles miscellaneous.

In the *Gonda District* the Forest Reserves were partly formed direct from Government land and partly from land which had been resumed from grantees; all the main forests north of Tulsipur had never ceased to be Government, whereas the whole of the Nawabganj Forests had been resumed from grantees. The Gonda Forests included 43 square miles of *sâl* forest, 4 square miles *khair* and *sissu*, 61 square miles miscellaneous and 46 square miles grass-lands, or 154 square miles. Both the Bahraich and Gonda Government Forests were declared Reserves in February, 1879.

It was understood that the conditions of the Waste Land Rules of Oudh, from which the reserved forests had been formed, precluded the possibility of the existence of any rights within these forests, and the fact had been acknowledged by the Local Government on several occasions. Owing to the complicated correspondence which had gathered round the question of "privileges" in Oudh, which privileges had by some Collectors been confounded with, or treated as synonymous with, "rights," Ribbentrop advised that "a formal declaration of the fact that no rights whatsoever exist would settle the question for ever, as the accrual of any new rights, except under grant or contract, could be barred under Section 22 of the Indian Forest Act."

On the subject of these privileges Ribbentrop pointed out that in Oudh it had been already proved that they had not been valued by the grantees whilst they formed a burden on the forests which placed unnecessary difficulties in the way of any change of management and more intensive working, and this would ultimately affect the community at large. The villages near the forest were, as a rule, not settled communities, but mere congeries of graziers who frequently made their livelihood out of privileges, conferred in order to encourage cultivation, by grazing cattle belonging to people as far down as Lucknow. The type of cattle was also a miserably poor one, owing to constant inbreeding, the majority not being kept for agricultural purposes (II, p. 537). It was said that the forests were so large that it was therefore necessary to grant the privileges. Yet the forests of the Central Provinces were far more extensive, the population much smaller, and yet no privileges

existed and no difficulties were experienced at the time. "If," said Ribbentrop, "it was still considered necessary that the agricultural cattle of the villagers within a 3-mile limit from the Reserves should graze their cattle at lower rates, this can be effected by executive orders bearing force for limited periods, and it would probably be advisable to restrict such concessions to *bona fide* agricultural cattle in proportion to the area under cultivation. The Commissioner of the Central Division, Bombay Presidency, considered that one pair of bullocks can be used to work about 24 acres of land. I therefore recommend that the rule should be that one bullock should be allowed to graze free for every 10 acres of land held by a *ryot*."

On this subject of cattle grazing in the Oudh Forests Eardley Wilmot has an interesting note (*Forest Life and Sport in India*) referring to this period in Oudh. "The Gujars (cattle men) are a tribe apart, who keep herds of buffaloes and make a living by the sale of milk and butter. They dwell in the forest, selecting a place for their huts in the vicinity of grazing and water, moving on as these become scarce, and roaming far into the Himalaya in the summer. Their buffaloes return to the station twice a day, morning and evening, and after being milked wander off again into the forest, sometimes alone, at others accompanied by a youthful Gujar, who often reclines upon the broad back of one of the cows. The Gujars know no fear; they were in the past a martial race, and to-day they show no subservience and present picturesque figures as they stand on the high wooden sandals, robed in black blankets and armed with formidable 6-foot bamboos. They are one of the numerous forest tribes with whom the Forest Officer comes into frequent contact and from whom he learns the characteristics and habits of an uncivilized Eastern population—habits which he may condemn, but which he must acknowledge to have good reasons for their origin."

In the last few lines lies the success or otherwise of the Forest Officer and the progress of forest conservancy. All over our Empire the Forest Officer is the pioneer in contact with the forest tribes. Success and rapid progress, as this history will have shown, will entirely depend upon how the educated and trained Forest Officer adapts the introduction of his conservancy methods to meet (perhaps modify) the modes of life, customs and practices in force from time immemorial, of the forest tribes.

Protection of the Reserves from fire was impossible as long as grazing privileges were allowed under the existing arrangements (II, 367). In his Report Ribbentrop deals in detail with the condition of and suggestions for the future management of the Motipur, Kheri, Bhira, Puranpur and Pilibhit Reserves; his main thesis being the proposed Working Plan for the Kheri Forests.

The Motipur Forests.—The Motipur Reserves in Bahraich were estimated at 127 square miles, 60 square miles of which

occupied the high-lying alluvial lands covered with sâl forests, the other 67 square miles being low-lying grass-lands interspersed with belts of *khair* and *sissu*. "From a purely forest point of view," says Ribbentrop, "the sâl forest is, under existing circumstances, and with the present state of the demand and market, by far the most valuable, though it is impossible to say what changes may take place in this respect in consequence of the rapid development of railways and other improvements in communications." Ribbentrop's examination of this forest is of interest, since he was able to show that the variation in the quality of the forest and its stocking—"the forest . . . is deteriorating ~~under~~ our very eyes in the character of the *peuplement* and continuity of the leafy canopy; topsore and dying poles are numerous, and the ground is covered with a growth of *Holarrhena*, instead of sâl reproduction,"—was due, not to a varying quality or depth of soil, but to constant grazing and fires. The changes in quality of growth were abrupt and followed the boundary of the forest areas which had been continually protected since 1878; and even those areas south of the Jalia-Salarpur line, which had only been added to the Reserves in 1880-81 and 1884-5 respectively, already showed signs of improvement in proportion to the time of protection. He had little doubt that all unprotected forest would follow areas from which the sâl had already disappeared and become extinct. Ribbentrop's suggestions for the future treatment of this forest, when the position of forest conservancy generally in India at the time they were written is borne in mind, are of considerable interest, since they indicate the advance towards higher forest management which was being made in Oudh.

"The protected compartments in the Motipur sâl forest, at least those which have been continuously protected since 1878, are covered with an advance reproduction of such density and completeness that, from a purely forest point of view, the greater part of the old timber could be taken out at once. The present state of reproduction would permit the reaping of the greater portion of the mature crop, and it is only in order to ensure a continuity of the supply that felling is required to proceed gradually. This has been fully recognized, and the fellings as at present proposed and carried out in these compartments leave nothing to be desired. The general plan of treatment is both feasible and practicable. The plan is that where the advance reproduction is complete, all trees overhead are to be felled, with the exception of such sâl trees as are quite straight and healthy, and which promise to yield large,

sound, and straight timber in the next rotation. None but the very soundest trees are to be spared, and the number to be left is therefore dependent on the present state of the forest in each locality. This naturally differs, but on the area already treated the number of sound poles left on the ground averages, according to an eye estimate, from fifteen to thirty trees per acre, girthing from 1 to 3 feet.

The advance growth, which is by no means pure sâl, but which contains a sufficient number of trees of that species to form a sâl forest, is at present to be left undisturbed in its composition, in order to allow of its out-growing the injury caused by the present felling operations, which is naturally, in some instances, very considerable. After two or three years, or as soon as the effects of the working have been effaced, it is intended to weed out, as far as necessary, the saplings and young poles of inferior species in favour of the sâl. The result of these operations will, if fire protection continues to be successful, be, after a comparatively short period, the formation of a healthy young pole forest of sâl, with vigorous standard trees; and from such forest grazing need, probably, not be entirely excluded till the time comes round for it to be worked again. In this way a certain area may, if it be considered necessary hereafter, which I doubt, always be utilized for grazing when the forests shall have once been brought into a healthy state; but at present we must recognize that they will suffer from former bad treatment, and that, in order to re-establish their potential capabilities, a much closer protection must be enforced than may hereafter be necessary."

The Inspector-General advocated the preparation of a simple Working Plan for the Motipur Forests. An enumeration of the growing stock would not be necessary, it would probably be sufficient to divide the forests into areas for each year's felling by estimates based on ocular observations only, but fire protection of the whole area was essential, "for it is impossible to conceive a reasonable and feasible Working Plan which takes such eventualities as constantly recurring fires into consideration." Certain exchanges of land, with a view to removing a few unimportant villages who grazed their cattle within certain parts of the forest (and consequently fired these areas yearly), were under contemplation, and Ribbentrop urged that these changes should be affected. The Forest Officer in charge of these forests and also of Bahraich was Dansey, and in order to utilize his local knowledge to the full it was recommended that he should be given an Assistant. The development of means of communication and the search for a steady market would have to continue hand in

hand with the preparation of the Working Plan, so as to assure a demand up to the ascertained capabilities of the forest. This question was being taken up by Captain Wood, the Conservator. The construction of a permanent tramway between Sujauli and Nishangra, with a movable branch from thence into the forest, which should be of the same gauge, would, said Ribbentrop, greatly assist in developing a steady market, and he instanced the tramway into Changa Manga. It will be apparent that Oudh was going ahead of other Provinces in these matters.

The *khair* and *sissu* forest belts in the grass-lands were subjected to annual conflagrations in order to produce an early crop of new grass. Consequently a Working Plan would be useless and reproduction was too uncertain to be utilizable. As long as these conditions remained no felling could be prescribed for these areas, as the Forest Department would then be only assisting in the more rapid disappearance of the forest belts. Ribbentrop strongly disagreed with the proposals which had been advocated elsewhere (by Brandis) that fellings might be undertaken in open and unprotected areas of forest outside the protected ones. In the absence of sufficient proof to the contrary Ribbentrop admitted, though he remained unconvinced, that the whole of these low-lying areas might be more valuable as grazing areas than as forests. It was, however, by no means certain that these conditions would remain unchanged. The value of the *khair* and *sissu* forests might largely increase by the development of railways; and in any event he considered the present method of utilizing the grass crop by firing and grazing *in situ*, instead of cutting it, extremely wasteful. He recommended the closure of certain areas, and that they should be protected against fire in order to study the effect of such closure on forest reproduction, and he suggested the Bhartapur block for the experiment.

On the subject of the Bahraich Forests, Eardley Wilmot, who was in charge of them in the late seventies, wrote (in 1910): "The forests here consisted of four separate blocks: that to the west named Motipur, now a station on the Bengal and North-Western Railway, whose line runs through the whole area; then follows eastwards: Chakkra, Charda and Bhinga, the Nepal frontier forming the northern boundary of each forest. In those days the Motipur sâl forests on the high ground were full of game, and the lowlands stretching away to the Sarda River in the west, and the Girwa River in the north

were called by the natives the 'home of the wild beasts.' Nishangara stood on a bluff in the centre of this sportsman's paradise, overlooking the plains, and a snug double-storied house that I erected now replaces the grass shanty found on my arrival there. Cultivation has since spread up to the forest boundary, and the rumble of the locomotive is now heard throughout the day; and listening to it, it is curious to reflect that not so long ago the wild buffalo was seen in these swamps."

The Kheri Forests.—In the absence of a survey the 263 square miles of forests in Kheri were roughly classed as follows at this period. The most important were the sâl forests which occupied the high alluvial lands between the Mohan River and the Sarda, or more correctly the Suheli, which, during a great part of its course, evidently once formed the bed of the Sarda. The *sissu* and *khair* forests, which presented much the same characters as those of the Bahraich Reserves, occupied the low land on both sides of the Suheli, whilst the miscellaneous forest was found chiefly on the low-lying areas on the Kauriala River, both north and south of Ramnagar Ferry.

The sâl forests, as is common in the region with this type, were mixed with *sain* (*Terminalia tomentosa*) and other valuable species, for which there was no great sale at this period. But these forests were recognized as being amongst the most valuable in Upper India. They extended for a distance of about 31 miles, with an average breadth of 7 miles. They did not, however, form a continuous belt like the sâl forests of Bahraich, but included numerous large open areas of high grass (*phantas*), some of which contained hamlets and a certain amount of cultivation belonging to the Raja of Singahi. The forest was also honeycombed by smaller glades from a few acres to upwards of a square mile. The origin of these *phantas* was a depression with insufficient drainage forming "jheels" or swamps, conditions inimical to the growth of the sâl. In many cases there appeared little doubt that the extension of the *phantas* into the *bona fide* sâl forest had been in many cases due to the practice by the Tharus (*vide* Eardley Wilmot, II, pp. 19, 20) of a kind of *jhum* (shifting) cultivation, this tribe having settled round the more permanent of the jheels. That these people had in the past shifted from time to time was evidenced by the existence of clumps of mango, *pipal* and *bargat* (*Ficus bengalensis*) trees and groves of guavas miles away from their present location. The area occupied by the Tharus in the forest was about 30,000 acres. For several years, from 1873,

Eardley Wilmot was Assistant Conservator in these forests, and departmental working was in force as detailed in a previous chapter. He writes (*Forest Life and Sport in India*): "The work was congenial enough, though consisting chiefly of the exploitation of the forest by selection fellings, the logs being either brought to depot and sawn on indent or floated down the rivers, to arrive months later at Bahramghat, then a railway terminus on the Gogra River. There was also some road and bridge-making to be carried out, and the forest was being cut up into blocks by straight rides of from 15 to 100 feet in breadth, whilst buildings had to be constructed, which necessitated the burning of bricks and lime."

Ribbentrop has some most interesting and suggestive remarks upon the variation in the conditions of growth, of the soil and other silvicultural data; he states that "the best mature sâl forest, locally known as the Mohân Sâl Forest, is found on the sloping ground which stretches north-east of the depression in which the Mujhla and Badhi Tals are situated; and throughout the Reserve the best-grown trees of this species were observed on ground inclining gently towards a depression or *phanta*. In these localities the sâl forest is also as a rule purest in composition." The Working Plans Officer would have to separate, in describing the compartments, the best sâl areas from the general type of the forest, but the Inspector-General stated that the former "were by no means as extensive as is generally supposed." His observations led him to form the conviction that the differences in growth were due in greater part to fire damage than to variations in locality factors. Advance growth (i.e. natural regeneration) was, as a rule, abundant in those areas from which fires had been excluded for a longer period, though almost wanting in areas which had been burnt over after the protection of one or two years only. On this subject Ribbentrop has the following suggestive remark on the subject of obtaining natural regeneration in areas covered with high grass, a problem which was to give trouble for many years thereafter: "The foregoing remarks show that the safe and certain guidance and management of sâl reproduction in a forest with a tendency to grow dense and high grass is a problem of considerable difficulty. It is beyond question that continuous fire protection will, as a rule, ensure sooner or later, by a gradual reduction of the grass crop, the wished-for result; but it is desirable that the end should be attained more speedily. I am of opinion that the most serious

mistake made in this respect is, the felling in forests before they are closed to fires and grazing ; for it is highly desirable that the sâl reproduction should be established before the dense grass crop, which invariably follows a fire in a forest with open canopy, takes possession of the ground."

Next to sâl the *Terminalia tomentosa* was the most valuable and, in many parts, the most numerous species. It resisted fire better, and excellent sâl reproduction was often found under a mature forest of this species, due, says Ribbentrop, to the height of the leaf canopy above the ground, and to the fact that the *Terminalia* is leafless when the sâl seed drops and germinates. It is impossible to follow him through his interesting remarks and suggestions for the future treatment of the forests—but it affords matter for serious reflection that the very large number of reports of this nature, written at the time by the few trained Forest Officers of experience, were not made available for future generations of Forest Officers. How many of us, who followed and were working in sâl areas ten and fifteen years later, had ever heard of, much less had an opportunity of consulting, many of these valuable Memoranda issued by the Inspectors-General of Forest. They (the Memoranda) were pigeon-holed and progress was delayed until the Research Institute came into being twenty years later and found its feet a decade afterwards.

The Inspector-General gives a tabular statement, showing the effects of the attempts to fire protect the compartments over sixty-six square miles of sâl forest in Kheri (Trans-Sarda). His own observations in this area led him to think that successful protection from fire for five successive years caused a reproduction and advance growth strong enough to recover from, if not to resist, an occasional conflagration. After discussing the danger caused by the annual firing of the forest by the graziers in the open compartments he advised that the whole of the Kheri Forests actually under sâl should be closed and fire protected. He suggested that the forest should be divided into six fire-blocks by cleared lines a quarter of a mile wide on the principle he indicated. To ensure the success of these proposals it would be essential that all the enclosed *phantas* should be under the entire management of the Forest Department ; the acquisition by exchange of those belonging to the Raja of Singhahi had been recommended by the Conservator. It was also proposed to dig wells or tanks (ponds) wherever necessary, within all the *phantas* which were extensive

enough to support a herd, to erect sheds round the wells and to place, after the *phanta* had been burnt annually by the Forest Department, a grazier in charge who would be responsible that no fires were lighted during the dangerous season except near the settlement, and that the cattle did not stray into the forest. A few simple but strict rules were all that were required for these people and, once they understood that they would have to leave the *phanta* if fires occurred or their cattle wandered, they would soon come to be a source of protection instead of a danger.

It will be remembered that several forecasts of the possible yield from the Kheri Forests had been made, the first in 1863 (I, p. 511) and a revision in 1868 by Brandis and Wood (II, 362). In 1863 it had been estimated that the Kheri Forests would be able to supply 4000 mature trees annually. In 1868 the number was reduced to 2900 which included also *Terminalia tomentosa* and *haldū* (*Adina cordifolia*). In 1870 a plan of improvement fellings was drawn up by Wood, the Conservator, for the years 1870-1 and 1871-2, which was to run in addition to the 1868 felling plan. The fellings of green timber were to be carried on the same as before, but the areas in which such fellings had been undertaken were to be located block by block and all unsound sāl trees were to be coppiced and all dead trees and trees of unreserved species were to be felled and converted into scantlings or fuel. The second- and third-class trees, where necessary, were to be thinned out and each block taken in hand was to be protected from fire and grazing. These improvement fellings were not commenced till 1874-5, when 82 acres of rather poor forest were treated. The out-turn was 8331 cubic feet of sawn timber and 125,000 maunds of fuel. In 1879-80 the number of mature sāl to be felled was reduced to 2000 per annum. In the following year Wood reported that the forests were not being worked to the extent they were capable of and suggested that a much larger number of marketable trees might be felled, and that in addition all unsound and crooked trees should be utilized where possible. Brandis was asked to advise on the question and stated the following conclusions :

(1) That the out-turn of timber at 3000 trees per year for the past eleven years from the Trans-Sarda Forests was only a small proportion of what they might yield if fire-protected. (2) That until they could be so protected it was desirable to cut as little as possible so as not to open out the forest and thus prevent the high

growth of grass and consequently increased damage from fire. (3) That in forests unprotected from fire selection fellings at the rate laid down in 1868 should be adhered to, but that in protected areas fellings on the plan commenced in 1874-5 should be continued, provided financially remunerative. (4) That after fire protection had been fully established, the forests should be worked to their full extent, the fellings being only regulated by the necessity of leaving seed-bearers where young growth was wanting or of maintaining a sufficient annual supply of timber until the younger age classes had attained maturity. (5) That, as a preparatory step, valuation surveys should be made whenever possible and that the rate of growth should be determined by annual measurements and the counting of annual rings in saplings of known age. Brandis again inspected these forests in 1881. He laid down the lines of the future management. He noted that as a result of the improvement fellings of 1874-5, wherever a complete clearance had been made the first result was always to increase the quantity of grass, and though young *sâl* required light it was essential in the first place to kill out the grass as much as possible. As soon as any blocks or compartments had been completely re-stocked all marketable trees should be cut and unsaleable trees other than *sâl* be killed by girdling. The proportion of "Asan" trees was to be diminished by allowing the villagers to cut poles of this species free. The selection fellings should be continued outside the 65 square miles which were demarcated and fire protected; in the latter no green trees were to be cut, except hollow trees for boat hulls. The selection fellings between 1861-80 had yielded about 50,000 mature trees, the fellings extending over the whole of the northern portion of the forest, or over about 70 square miles, yielding about 714 trees per mile. The northern part of the forest, of which 40 square miles were outside the area proposed for protection, had been worked before it was taken over by the Forest Department and could not be expected to yield more than 350 trees per square mile. The forest to be worked over in the immediate future comprised, therefore, an area of about 40 square miles, estimated to contain 14,000 marketable trees. During the next five years 2500 green *sâl* trees per annum were to be felled, and then, if necessary, a few years more yield might be taken from the northernmost blocks, where felling had been carried out ten years previously. In this fashion the annual yield for eight years, from 1881-2, would be provided without having to cut in the fire-protected areas. All marketable *sâl* trees 6-foot girth and over, were to be cut, save where necessary to leave them as seed-bearers or when they stood on the edges of blanks, and the fellings were to proceed progressively through the compartments, each being worked out before another was taken in hand. As soon as fire protection had been efficiently established a descriptive account of each compartment should be drawn up,

when some of the compartments would require to be subdivided. Under this forecast (permitting 2500 green sâl to be cut annually) the fellings which were actually made between 1881-2 and 1885-6 were 70,946 sâl trees and 16,580 *asan* trees, giving an annual out-turn of 14,189 sâl and 3316 *asan* trees respectively.

Ribbentrop comments upon the prescriptions and the excess fellings which had taken place as follows :

“ It has been sought to defend the excess cuttings of this period by balancing them against short fellings previous to the date of revision ; but this is not admissible, for each new revision is based on data as they appear at the time, and therefore already takes previous short fellings into consideration when fixing the annual out-turn. On the other hand, the forecast of 1881 takes only the thoroughly sound timber-yielding trees into account, as there was no market at the time for unsound or crooked timber which would only yield scantlings of small dimensions, but there was no demand for *asan*. Captain Wood was, consequently, quite right in grasping the opportunity of a sudden demand for railway sleepers, provided it can be shown that the recent fellings were justifiable from a sylvicultural point of view.

In considering this question, the point must not be lost sight of that the construction of the railways enhances the value of the forest property to a considerable extent ; and even should it be proved that the recent fellings were beyond the annual capabilities of the forest, which is doubtful, or that they were otherwise somewhat injudicious, the exceptional circumstances of the case warranted exceptional measures.

The selection fellings have been kept within, or at least sufficiently near, the provisions of the forecast of 1881. With the principle of these selection fellings outside the protected areas, which was laid down in paragraph 99 of the forecast of 1881, I cannot agree ; for it is bad forestry to attack, however leniently, a forest which we cannot protect and which we do not intend to abandon. The blanks caused in open forests by such fellings have a tendency to increase under the influence of annual fires, rather than to be filled up by young growth ; and, as a rule, the finest forests are the natural fields of such selection-fellings as prescribed, where selection means only a search for the best timber trees. In addition to the principle being wrong, the fellings have not always been carried out with due regard to the proviso that no trees were to be felled on the edges of blanks.

Previous experiments to utilize and export inferior trees in the shape of small scantlings had resulted in failures, and the only forest produce that admitted of remunerative extraction, even as late as 1881, was sâl timber in the log. No provision was consequently made in the forecast of that year for the utilization of any

but large timber-yielding trees. Then came the demand for sleepers, causing the exploitation of 56,691 trees. The sleeper fellings have to a great extent been confined to closed blocks, but they have also been extended to open forest near Bilraien and Badhi Tâl. The trees felled for sleeper cutting, though inferior and malformed and unfit to yield timber, were, as a rule, selected for their soundness, in order to obtain the largest possible out-turn ; but, nevertheless, they averaged only about eleven sleepers per tree, and the forest is filled with worthless wood and branches, for which there is no present market.

As already said, the trees felled for sleepers could under no circumstances have yielded long timber or scantlings, and in so far no loss has been experienced by their exploitation ; but the fellings for sleeper operations, following the selection fellings prescribed by the Working Plans, resulted in a considerable reduction of sound seed-bearers.

In the fire-protected compartments this is, in my opinion, of no injurious consequence, and from a purely forest point of view is rather beneficial than otherwise ; for a sufficiency of seed-bearing trees have been left, in every locality I inspected, to ensure reproduction, and this will in such places be stimulated by the opening out of the forest. If fires are successfully kept out, the enormous quantity of dead wood now lying in the forest will, moreover, not be lost, if the demand for firewood expected to arise in consequence of the railway construction becomes a reality.

In all open or unprotected forests, subject to annual conflagrations, sleeper operations are an unmitigated evil, and largely magnify the injuries already effected by the much more lenient selection-fellings, and here the large quantities of dead wood must largely add to the destructiveness of forest fires. Till fire protection is therefore extended to them, all exploitation of these unprotected areas ought to cease. The rule that no seed-bearing trees should be felled on the very edges of blanks and *phantas* has here again not everywhere been sufficiently attended to.

The extraction of *asan* trees, which of late has assumed considerable dimensions, is in consonance with the recommendations made in former Reports and Suggestions. At the time when the wholesale extraction of this tree was recommended, it had no particular value, and was naturally regarded as a component part of the forest, which it was well to get rid of in order to make place for *sâl* reproduction. The conditions have since altered, and *asan*, though still much less valuable than *sâl*, is no longer valueless, as it was a few years ago. I have, however, even now no objection to offer to the extraction of mature *asan* trees in fire protected blocks without much reference to the number of first-class trees available, as long as it is remunerative ; but no fellings of this tree even should take place in unprotected compartments."

He then makes suggestions with regard to the proposed Working Plan which need not be gone into here. He says, however, that a forest situated like Kheri should, if protected throughout and brought into complete working order, yield probably four times the number of trees it had done on an average even during the years 1880-1 to 1885-6. The extent of the enumeration of the growing stock would depend on the system of management contemplated in the Working Plan, but he thought it would be possible to undertake the enumeration in one season. The demand of the railway had changed the position in this respect. Before the sleeper demand, for which sound shorter trees could be felled, the demand only existed for sâl timber of large dimensions, and probably no other system than that prescribed to date could have been undertaken, but they could not be called "true selection fellings," for the trees were only "selected" from a purely commercial point of view and not from a silvicultural one. Moreover, a safeguard against deterioration of the soil is only ensured to a small extent by the method, even when the area is fire protected, for it is doubtful whether the removal of single trees here and there always opens the canopy sufficiently to permit of a complete reproduction. But, even with the sleeper demand, only a small proportion of the trees were fit to yield them, and again purely commercial selection was the rule and Brandis' stipulations with regard to seed-bearers and trees near the *phantas* had not been respected. Ribbentrop considered, however, that it would be difficult to supervise fellings carried out in this fashion and, "as long as the present conditions of the market remained unaltered, it will hardly be possible to change the system which has been forced upon us by circumstances, under which the working of the forest must be entirely on the amount of marketable growing stock throughout the forests and its rate of growth. The work cannot be sufficiently concentrated to assist reproduction by a more highly silvicultural system of felling affecting the entire *peuplement*: we must therefore remain dependent for reproduction mainly on fire protection."

Ribbentrop believed in departmental working and wished to obtain natural regeneration if possible as a result of, and in conjunction with, the working of the forests in this manner. Starting from the basis that fire and grazing must be excluded, he considered that the point of importance was that a considerable opening in the canopy was necessary. To this end,

and in order at the same time to exclude the drying influence of hot winds and the sun, and so maintain the soil fresh and active and at the same time to keep down the heavy growth of grass, Ribbentrop says, "*personally I would prefer to see the introduction of strip fellings.*" The italics are the writer's. Ribbentrop's proposals for the Working Plan were as follows :

" Under these circumstances, I would feel inclined to divide the forest into twenty blocks, with a somewhat equal stock of trees. I would then fell, on parallel *strips* 150 to 200 feet broad, all first-class trees and such of the second-class as are unsound and malformed beyond recovery, leaving alternate strips of the forest untouched. This will, if we again accept, for argument's sake, the figures obtained by the recent enumerations, give an out-turn of 2200 sound mature trees, 5300 unsound trees of the first class, and probably some 5000 unsound or crooked trees of the lower classes, and consequently lead to the removal of some six trees per acre. Their felling, conversion, and extraction will for the time being destroy the grass crop, and thereby ensure the germination of the seed, and the forest will be sufficiently opened on the strips operated upon to permit of the maintenance and development of the young growth. The belts of intervening untouched forest will contain a sufficient number of seed-bearers and ensure the maintenance of the freshness and consequent fertility of the soil. The annual out-turn will increase year by year in as far as second-class trees grow into maturity on the belts which are to be worked at a later period. I propose a rotation of forty years, during which to cut once over the entire forest, in order to be on the safe side. It may be that facts collected during the next season will enable us to shorten this period, or, possibly, future experience will show that the rotation may be shortened and that the areas to be worked can consequently be increased. As a fact, I have used figures in this proposal only to explain my design more clearly. If accepted, it rests with the Working Plan Officer to work out the details."

With reference to the other forest tracts and grass lands, Ribbentrop did not advocate any interference for the present, for they "are not as yet sufficiently valuable and necessary to the State to be worth the unpopularity which would arise from an abrupt interference with an established custom, however objectionable it may be in the abstract, further than is absolutely necessary."

The Bhira Forest.—This forest is a projection from the Kumaun Terai. It was almost pure sâl, but of very inferior growth and character, even when compared with the worst parts of Kheri. More than half the area was occupied with large *phantas* covered with a low bushy scrub jungle of sâl, which died down each year, being killed by either frost or fire,

or both, in one season. The bases of the stems were gnarled, twisted and knotted, and it was from these that the shoots were sent out year after year to be destroyed. Ribbentrop doubted if coppicing would produce any good results from such excrescences. For the rest of the forest he prescribed fire protection and strip fellings, for he says that "strip fellings in the fire-protected area, which were made three years ago near the central forest-house, have yielded sufficiently favourable results to commend a similar treatment for all fire-protected areas." This forest is outside the Terai, and was surrounded and intersected by the cultivation of many populous villages.

The Puranpur Forest.—This forest is a continuation of the Bhira Forest towards the north-east. The soil was both deeper and better than in Bhira, but the tree growth even worse, and this was directly attributable to the gross abuses to which the forest had been subjected. Ever since 1850 the villages of the pargana had been permitted, under an order of the Commissioner of Rohilkhand, to make unrestricted use of the forest, grazing, firing and indiscriminate hacking, especially of sâl poles and saplings used for rafters and fences, such as described by Read (II, p. 356), being practised unchecked.

Under the recent Settlement the Maina Kot and Dhanaura blocks, about a third of the forest, had been entirely closed as Government property free of rights. But the rest, the "open forest," unless protected, was lost both to the State and the community.

The Pilibhit Forest.—This forest is divided from the Puranpur Forest by the Mala Swamp. The soil was similar to the latter, but the growth better, owing to the villagers having had to pay for all produce taken from it. About 7852 acres of this forest had been fire-traced for years, and in some of the fire-traced compartments strip-fellings were made in 1883-4 and the three subsequent years. The results of the operations, Ribbentrop says, were an unqualified success, the strips of 1883-4 being covered in 1886 with an almost complete thicket, varying in height from 6 to 16 feet. Since reproduction of this nature can be ensured the Inspector-General recommended that a Working Plan should be made, for its preparation would present no difficulties.

In 1890 Eardley Wilmot became Conservator of Forests in Oudh, and during the next nine years he undertook the reorganizing of the management of the forests. He had never been enamoured with the method of departmental working in

force, which he thus describes, alluding to his earlier work in the Circle : " Besides the protection of the forests there was its exploitation by means of departmental operations, a now antiquated system, which afforded to the subordinates unlimited opportunity for bribery and oppression, and occupied the whole time of the Forest Officer in detailed accounts which were impossible to check in the field. In those days the Forester was, beyond everything, a timber-merchant and a revenue collector, and this state of affairs naturally hindered sylvicultural progress, for no time was left for the higher professional duties of the staff." It is not surprising to find, therefore, that one of the first pieces of reorganization to which he devoted his attention as Conservator was a change in this method of working the forests. Eardley Wilmot admits that a change in a system of management in any industry does not necessarily imply adverse criticism of previous authority, and this is specially the case in forest administration when in its infancy. As the Conservator says :

" It is well to recall that the methods of the past were at one time new, and doubtless involved difficulties in their introduction " (as this history will have shown was the case), " and that they were probably the best available under former conditions ; but there can be no progress without change, and the successful introduction of changes does but indicate that opportunity has been seized for making that progress. In the case in point, the Kheri Forests were being worked on the ' selection ' method, a system for which they were not ready, and which resulted in an inadequate out-turn. The felling, the carting, the floating of the sâl logs to Bahràmghât, their sale or sawing to indent—all these operations were carried out by a multitude of petty contractors, and the accounts of these men remained open for many months, being complicated with frequent cash advances, while at the same time the control of large quantities of timber spread over many miles of a slow and risky waterway, and its disposal at a distant sawmill, was not under efficient supervision. In the forest, again, the system led to serious sylvicultural disadvantages ; the best trees were, naturally, selected for felling, and the inferior stock was left on the ground, so that in theory as well as in practice, we were depleting the forest capital instead of building it up. It was not without some misgivings that the sawmill at Bahràmghât was closed after investigations that, to put it mildly, exposed many serious irregularities ; and the question then arose how to induce the extremely conservative members of the Indian timber trade to risk a new departure in a forest with which they were unacquainted. Fortunately my dealings with these men in past years had given them sufficient confidence to follow me in

my transfer to Oudh, and from this side there was not much difficulty ; that lay rather in closing accounts with contractors and subordinates, a task which occupied much time, and revealed some transactions almost humorous in their impertinence."

In the Inspector-General's " Review of Forest Administration for 1891-2 " the backwardness of Oudh in forest organization (for Oudh had lost its former pre-eminence) is commented upon. In 1892-3 the Government of India (in the " Annual Review ") note the marked progress in the preparation of Working Plans which had taken place under the guidance of the Conservator, and they had also remarked upon the excellent results which had attended in this Circle the efforts made to improve during the past four years the organized exploitation of forest produce.

The Conservator's next task was to make a regular Working Plan for the area, and part of this work was entrusted to Mr. Keshavanand, " a man who had been trained at Dehra Dun and had supplemented this training by much careful study. He undertook the enumeration of all the trees of two species in three age classes over the 150 square miles of forest. With this work accomplished, the basis was laid for determining the amount of timber to be felled annually, and the enumeration showed that it totalled in number of trees about four times those previously felled, and in volume even more than this would appear to indicate ; for sawing was carried out in the fellings, as well as logging, in order to work up all the inferior material. The promise of an annual out-turn for a fixed period of years prescribed by the Working Plan was sufficient to induce the Rohilkhand and Kumaun Railway to construct a branch line from Mailáni to Dudua, and this new departure finally insured the change of system which freed the Forest Officer from the duties of a timber-merchant and gave him some time to devote to the scientific working of the forest." This line, as it served the timber and grain trade of Nepal, proved a paying one and led to the construction of others to tap the villages and forests of Bahraich, Gonda and Gorakhpur. The success following the introduction of the Kheri Working Plan was so marked that it led, during the next few years, to the compilation of other plans for the whole of the workable forest areas of Oudh. With reference to these plans and the obvious great value of their introduction (for scientific forestry or a guarantee that a forest is not being overworked cannot be said to exist until Working Plans are in

existence) Eardley Wilmot remarks: "The period covered by these plans has long since expired, but they have been since followed by others that are similar, but even more exact and more effective, because at the time of their compilation more detailed records of the past were available as to the rate of growth of the timber, as to the reproduction of the species, as to varying effects of soil and locality—in short, with regard to all those items of local knowledge that are essential for the progress of Indian sylviculture."

The demarcation work of the forests, always an intricate matter in a populous country-side, to which allusion has already been made in previous pages, had been by no means satisfactorily settled, and this was the second matter taken up by the Conservator. In consequence of the opening up of the area, cultivation was pressing on the forest boundaries, which were lengthy and intricate and far from being satisfactorily defined. With the object of shortening them and consequently cheapening their upkeep it was decided to effect, where possible, exchanges of land between the Government and adjacent landowners, a process which absorbed much time, as it probably would in any country where landownership was valued by the private individual. As the process was gradually effected in each locality the boundaries were permanently fixed by means of numbered sandstone pillars from the quarries of Mirzapur; and between each pair of pillars a bridle path was constructed, so that, whether mounted or afoot, inspection could be easily carried out, whilst the boundary was plainly visible to the public, and prosecution for trespass would lead to conviction in the Courts. The delineation of a boundary by stone pillars is expensive, and can only be carried out where the annual revenue to be expected from the forest justifies the expenditure. Cheaper and more temporary pillars are in use for first demarcation of forest areas, such as blazing trees, mounds of earth or stones, or a green cutting or stake of a tree driven into the ground in the hopes that it will root and so forth (cf. II, p. 478). One of the exchanges had reference to the area of 30,000 acres occupied by the Tharus alluded to above. It was desired to bring these people under the control of the Forest Department, and they themselves wished it; they were in close touch with the Forest Officer and dependent on the forest for their livelihood. To settle them down within the forest in forest villages entirely under the Department was as great a gain for them as for the Forest Officer, who thus had

ready to hand an invaluable labour supply. Orders were, however, issued to hand over the Tharus to the Revenue Officer, a proceeding as short-sighted as it was distressing to the two chief parties concerned. It is refreshing to know that some ten years later, when Eardley Wilmot was Inspector-General, the matter again came up for consideration and, on his clear exposition of the case, the decision was reversed.

The third problem taken up, which cost an infinity of trouble and labour, was the preparation of the Record of Rights, a business which had not been settled. All villages within three miles of the boundary and, says Eardley Wilmot, there were many more in the now more populous country, were enumerated, with numbers of houses, cattle, acreage of land, etc., as also their requirements in fuel, grazing, etc., from the forest. Schedules were then prepared recording the annual grants of each to which the people were eligible. In this way the proportion of produce from the forests required for the local community was known and consequently the amount remaining for sale in the open market. This work occupied several years as it required constant reference to the Revenue officials.

The Conservator refers to the early difficulties experienced during the first-half of his service in the attitude of the Revenue Officers *vis-à-vis* the new department and he correctly ascribes it, as has already been mentioned earlier in this history, to the ignorance existing in England at the time in all pertaining to forestry and the impossibility of the Indian civilian at home obtaining any knowledge of forestry, since it was then a *terra incognita* at the Universities. And the same applied with even greater force to the higher officials, who had the framing of the general forest policy to be applied to a Province. That the Department received the support it did in these early days was due, as has been often reiterated in this history, to the surprising (if it may be so termed) foresight and statesmanship of successive Secretaries of State, commencing with the first Sir Charles Wood (I, p. 530), and to one or two of the Governors-General of that period.

During Eardley Wilmot's Conservatorship in Oudh Mr. P. H. Clutterbuck (later Inspector-General of Forests) was in charge of the Gorakhpur Forests, which were separated from Bengal by the Gundak River. He there shot the last surviving buffalo and also the last rhinoceros, which had wandered down from Nepal, killed in this district. At this period Mr. B. A. Rebsch, one of the more senior untrained officers, was in

charge of Gonda. The Bhinga Forests have been already alluded to—Eardley Wilmot has the following interesting note concerning them: "The forests of Bhinga present a curious appearance to the forester. Thirty years ago the area was peopled with ancient trees that rose abruptly from a bare soil hardened by the hoofs of numberless cattle; there was no young growth, the parent trees were without progeny, and as they fell from natural decay their place was filled by a thorny growth, impenetrable to man or cattle. It was Nature's last despairing effort to protect the fertility of the soil. For a generation the Forester fought against fires, cattle and man, and yet there was no response in the appearance or in the continuance of seedling growth, till later, under the protection of the thorns, a few little trees began to show, and, encouraged by the admission of light, sprang up to give in their turn protection to hundreds of their kind, to assure the tardy regeneration of the former forest. To one acquainted with the past history of this forest, two questions naturally presented themselves—whether a whole generation was required to rest a tired soil, and whether the planting of any other than the existing species might have met with success." As the Conservator says, to these questions answers are indispensable if the forester is not to invite serious sylvicultural failures. Research work to provide knowledge on the rotation of species is essential in all countries, and perhaps even more so in areas where it is desired for one reason or another to raise pure crops, which are even more subject to insect attack and fungus diseases. Research is a paramount necessity in India, and through research work there can be little doubt that, as Eardley Wilmot expresses it, "we may some day light upon the causes that are at work when studying, as we now do, to remedy their effects, and there will become open to us those sylvicultural secrets with regard to teak, to sâl, to other valuable Indian timbers which at present so often stand in the way of the forester in his efforts to aid in the regeneration of those trees on areas where magnificent forests once flourished, or stand in splendid maturity even in the present day."

CHAPTER IX

THE PROGRESS OF FOREST ADMINISTRATION IN BENGAL 1871-1900

THE position of the forests of Bengal and the commencement made in introducing forest conservancy was described at length in Volume II, Chapter XI. With the exception of some of the northern forest areas, but little real organization had been undertaken in the Province, and the position was retarded to some extent by the fact that Assam was still administered by the Lieutenant-Governor of Bengal, and the Government of India had been particularly anxious to have investigations made into the value of the Assam sâl forests. In the Annual Report for 1868-9 the proposed forest divisions were the Sikkim and Bhutan, Lower Assam, Upper Assam, Dacca and Chittagong, each of the divisions being divided into two subdivisions (II, p. 423). The formation of Assam into a Chief Commissionership in 1874 relieved Bengal of the forests in that Province. Leeds was succeeded by Dr. Schlich as Conservator of Forests in Bengal in December, 1872, whilst the Executive Staff was raised from six to eleven officers. As a result of Schlich's work a proper organization of the forests was introduced before he left the Province in 1878, including the demarcation of the Reserves and so forth. Various rather retrograde steps had been undertaken. The Chittagong Division had been made over to the Commissioner, who was appointed Conservator of Forests. Schlich's first step was to start an efficient system of collecting detailed information about the forests from which, in a few years, he was able to give a very good general description of the forests of the Province. In 1872-3 there were five divisions: (a) Cooch Bihar Division, coinciding with the boundaries of the Cooch Bihar Commissionership, the Forest Officers being under the orders of the Conservator. (b) Assam Division, coinciding with boundaries of the Assam Commissionership. The Forest Officers were under the Commissioner,

but the Conservator could inspect and controlled the accounts. (c) Dacca Division (Sylhet and Cachar), the Forest Officers nominally under the Conservator. (d) Chittagong Division, coinciding with the Commissionership, the Commissioner being Conservator of Forests. The Conservator, Bengal, had no control, but might be asked to advise. (e) Bhaugalpur Division, comprising the whole of the Western Districts, Chota Nagpur, Patna and Bhaugalpur. Forest Administration had only been really commenced in three of the above, i.e. Cooch Bihar, Assam and Chittagong. Schlich had some good officers under him at this period, Messrs. A. L. House, who had recently joined Bengal and had made an examination of the Sundarbans, Capt. Locock, G. Mann, H. Davis, A. P. Aylmer and J. S. Gamble, who had already commenced making a name for himself. Under the above described arrangements the Conservator of Forests was little more than an official Controller of Accounts. With the object of commencing an organized survey of the forests Schlich temporarily closed down the Dacca and Bhaugalpur Divisions, transferring the staff into the Cooch Bihar and Assam Divisions. This proved effective, but before work could be restarted in Dacca and Bhaugalpur, Assam was formed into a separate Province, which included the Goalpara, Cachar and Sylhet Districts. The Bengal Forest Department again dropped to two divisions, Cooch Bihar and Chittagong, of which the former contained 120 square miles of Reserved Forests and the latter none.

In dealing with this question Schlich wrote (*Pro. Rep. For. Admin. Beng.*, 1873-4, p. 1) : " However, steps have been taken, and an establishment sanctioned, to bring 178 square miles of forests in the Palamow sub-district, Chota Nagpur Division; under control and management. Moreover, there is a prospect of the Sundarbans Forests being brought under this Department, and there are forests in the Bogra Collectorate waiting to be examined ; so that the end of the year 1874-5 may find the Department grown again as much as the cutting off of Assam had temporarily reduced it. From a financial point of view the change will not be a loss to this Department, since Assam has always shown a considerable annual deficit." In this Report there is a summary of the results of House's examination of the Sundarbans commenced in 1872-3 and finished the following year. House furnished a most interesting account of the tracts of forest situated in the Jessore District, and gives a list of the markets to which the produce was taken

by boats, including Calcutta and numerous other places in the 24-Pargannahs, Jessore and Backerganj. In some of the latter markets *sâl* from Nepal was said to be purchasable. There were no villages within the tract. On the subject of ownership House wrote: "I am not aware of any rights possessed by the inhabitants of the surrounding districts, but at present anyone who is so disposed trades in timber and firewood from all parts of the forests. The 'fakirs,' who look after the spiritual wants of the woodcutters, and by the use of numerous charms and incantations do their best to protect their bodies from the tigers, in consideration of which services they receive a share in the value of the timber exported, have great influence with all classes of men who carry on the trade, and may be said to be working the forests on their own account, as they point out the allotments in which timber is to be felled; and without the 'fakir's' countenance and protection no woodcutter will enter any allotment. I have met numerous boats wandering about the rivers looking out for forests in which a 'fakir' has taken up his post." It will appear that the numerous tigers acted as a deterrent to overworking any portion of these forests in those days, for House writes: "The party working in No. 232 Allotment made an abrupt departure whilst I was anchored just opposite their head-quarters, in the Manki Khal, having lost six men carried off by tigers within ten days, and I met the 'fakir' who had charge of the working-party in No. 248 as I was going down the Pussur River, who was making off to some other allotment, he having lost three men during the previous week from the same cause!" Tigers and priests! it was a curious combination of a protective and exploitation staff; but it appears to have been the first. At the end of the summary of House's Report Schlich says: "The question of deriving a revenue from the Sundarbans is now before Government, and it is expected that a final decision on the subject will soon be arrived at." It will be remembered that in 1865 the Commissioner of the Sundarbans had stated that these forests were of little value (II, p. 386)! Their wonderful latter-day development is well known. Davis, as Assistant Conservator of Forests in Chittagong, had reported against forming Reserves in the Hill Tracts. His reasons were that these forests were vast, inaccessible and very difficult to explore, since the only means of access was up the rivers and streams. Once the latter were left there were no roads and few paths in the network of forest-covered hills. The Deputy Commissioner

and the Commissioner agreed with this view, but Schlich demurred at having the point definitely disposed of. As a matter of fact this great area remained "unclassed forest," and was so at the end of the period here considered, when the author held charge of Chittagong. Felling was still taking place in the forests, and the logs, etc., paid the royalties at the toll stations established on the rivers. The want of an adequate staff and the enormous area of the Division made any other form of working impossible. The Arakan Forests to the east, which were in the Burma Province, were without supervision. Schlich reported on them in 1869 and the author wrote a brief Memorandum in this connection after a visit in 1900. Some of the produce from the Chittagong Hill Tracts found its way down through Arakan into the Naaf estuary. Even in 1873-4 it was estimated that some 2000 boats were constructed here annually and a vessel of 200 tons was launched. The author saw much the same state of affairs in 1900, but sleeper cutting had been added.

By the end of 1875, instead of two forest divisions only, five had been formed, viz.: Darjiling, Jalpaiguri, Palamow, Sundarbans and Chittagong, the acreage of Reserves having risen from 120 to 1467 square miles, a noteworthy achievement. The Sukna Forests (6902 acres) were examined and valued during the year 1874-5, but other areas in the Terai remained to be examined. The additions to the Jalpaiguri Division Reserves were an area of 5 square miles adjoining the Muraghat sâl forest, and 110 square miles forming the Buxa Plains Reserve. The Muraghat Forest was reported to contain 171,590 sâl trees, principally seedlings and saplings. "It is not intended that any cuttings of growing trees shall be made for several years to come, and in the meantime the forest will be protected against fire, grazing and cultivation." Schlich considered the Buxa Plains Reserve to contain the best sâl forest in Bengal. It was divided into five blocks, an outline Working Plan for eight years had been made and an annual surplus of Rs.20,000 was anticipated. In the Sundarbans 885 square miles had been reserved in the Jessore District, and thus at length Government were claiming a revenue which was their own whilst saving these invaluable forests from destruction. Two Reserves were also gazetted in the Chittagong Division, the Mayanee Timber Reserve (339 square miles) and the Karnafuli Plantation Reserve of 8 square miles, which was to be planted with teak, *jarul* and toon. The Divisional Officers were once again placed

under the Conservator of Forests. In the Bengal Government Resolution on Schlich's Annual Report for 1874-5 the Secretary writes: "In the present condition of the Department it is a matter of secondary importance that the operations should be carried on at a profit." Nevertheless, there was a great increase in revenue and a decrease in expenditure, the figures being revenue, Rs.1,91,683; expenditure, Rs.1,09,349; surplus, Rs.88,334.

In 1876 Schlich was able to report 2585 square miles of forests as having been constituted Reserves, the chief work of the year, apart from the formation of Reserves, having been connected with demarcation, protection, the drawing up of plans of working and the construction of roads and buildings. The Palamow Division of 151 square miles was formed during the year, and more important still, the Saranda Forest in Chota Nagpur (450 square miles) was reserved as the Singbhum Division. The forest at the time was quite inaccessible, but, according to reports, was believed to contain several lakhs of trees of 6-feet girth and upwards. The author was in this Division when parts of this magnificent forest were worked for sleepers between 1896-8.

In the following year 60 square miles of forest had been constituted into the Hazarihagh (Chota Nagpur) Division and 40 square miles into the Sonthal Pargannas, thus making eight Forest Divisions; the latter, however, was not gazetted till many years later (1896). In 1877 Gamble was completing materials for his "List of the Trees and Shrubs of the Darjeeling District." E. G. Chester and F. B. Manson had joined the Province. In 1878 a reorganization of the Divisions was effected by Schlich, the five northern Divisions being Darjeeling, Tista, Kurseong, Jalpaiguri and Buxa. The staff was still small, but, wrote Brandis (Review of For. Administr. India, 1877-8, p. 5): "The revenue, however, has not yet been developed sufficiently to enable Government to provide the staff and establishment that are required to ensure the efficient protection and systematic management of all the forest ranges." But in these six years Schlich had accomplished a magnificent work in introducing a sound forest organization into Bengal and in having at his back the support of strong Lieutenant-Governors.

Brandis visited some of the northern forests of Bengal both in the plains and hills in January and February, 1879, and May, 1879, and in December of the same year. Schlich had

cutting broad exterior or interior lines where necessary and burning the grass early, fire tracing camping-grounds where timber works were in progress, and so forth. His detailed suggestions are of interest solely from the fact that they prove that fire protection had not made much progress in Bengal by 1880, and that the methods by which success was being achieved elsewhere were unknown. The areas which it was sought to efficiently protect were the Buxa and Apalchand Reserves. The Apalchand Reserve, mainly owing to its position, was regarded as one of the most important forests in the Duars. When conservancy was first commenced in Bengal the forest was overlooked. It was only after it had been visited by Schlich that, on his advice, it was made over to the Department. Before this step had been taken, one portion, bounded on the west by the Dalingkot road and on the north-east by the River Chel, which was extremely valuable, had been cut out because the forest had not been considered worth reserving. The total area of Apalchand was 16,640 acres. It consisted of a northern block, Rajadanga, stocked with sâl, and a southern, Chengmari, consisting of *sissu* and mixed forest in the north and sâl in the south. The establishment consisted of one Forester and two Forest Guards, which cannot be considered excessive even for those days.

Brandis considered the growing stock of this area as very satisfactory. A large portion of the forest consisted of poles of 3 feet in girth and 70 to 90 feet in height, sâl being the chief species, but with a fair mixture of other species such as *Lagerströmia*, *Dillenia* and *Careya*. "In places," he wrote, "the poles were more scattered, with high grass between, caused, doubtless, by the removal of all marketable large trees

for railway sleepers before the forest was declared a Reserve. No thinning is wanted, creepers are not very numerous. Fire protection is the chief work required, and it will doubtless have the effect, if successful, of completely altering the character of the forest in a few years."

With reference to the rest of the forests in the Western Duars, he considered that for the present all that could be done was to burn the grass-lands outside and a large proportion of the savannahs inside the limits of these forests. A more efficient fire protection would have to be delayed, the estimated annual cost of the fire protection advocated being Rs.72½ per 1000 acres.

As regards roads and compartment lines, Brandis' remarks applied chiefly to the Buxa Reserve, where a complete system of east and west lines had been cut through the forest. These lines were used as footpaths and one or two had been utilized for cart traffic. But as most of them crossed the drainage system of the country, at right angles, they would not generally be serviceable for the latter purpose. A large amount of standing and fallen dead timber was scattered all over the Buxa Reserve, for which there was already some export. This could be greatly developed by the construction of extraction roads on the lines of those existing in the Oudh Sâl Forests, which in many respects were similar to those of the Western Duars. In Buxa the road system should be constructed so as to assist the floatage of material down the rivers. The Inspector-General also advocated the removal of the station of Rajabhatkhawa, "which at present is in a confined space, surrounded on all sides by forest and without proper air-circulation, and which is, therefore, doubtless feverish." This wise proposal was not given effect to.

Brandis devotes a few words to the attempts to grow teak. Schlich had stopped this work, considering it a waste of money and energy, as at the time it certainly was. Greater success had been attained with sâl. It had been resolved to plant 100 foot sâl belts along the southern boundary of the Buxa Reserve with the object of keeping out fire. The work was started between June and August, 1876, the plants, about 2 to 3 feet high, being dug up from the forest and planted in lines 5 feet apart with 2½ feet within the lines. An attempt had also been made to sow up a part of this hundred-foot belt, but this had not been so successful. Two nurseries had been established and later a larger and better one was laid out.

Brandis was not in favour of these belts, which, besides being expensive, were naturally difficult to look after ; he advocated planting up blocks near the boundary. " Our present experience," he said, " seems to show that sâl can be readily transplanted without injury ; and I would recommend that seedlings be bedded out several times in the nursery before they are finally planted out, and that none under 2 feet high be planted in savannahs. The success of the transplants from the forest has been so remarkable that they should be used as much as possible in preference to other plants. The vigour of these transplants is doubtless due to the large knobs of wood which form the underground stem, the result of the forest fires, which kill the annual shoots year after year, while the underground portion increases steadily in bulk." Line planting, the grass being cut on 5-feet lines, was advocated for the blocks to be planted, and Brandis expressed the opinion that " the planting of sâl in the Buxa Reserve opens out a splendid field for experiments, which must be made systematically, on a large scale and on a well-considered plan."

In 1874 Schlich drew up a preliminary Working Plan for the Buxa Reserve which prescribed the fellings of sâl trees to be undertaken in the different compartments into which the forest had been divided. One of the difficulties in working this Reserve, which applied also farther east in Goalpara on the other side of the Sunkos River, was the absence of water in the dry season in the northern part of the forest. The carting season was short, lasting from December to March, and the sawing season from October to the end of April. Elephants could drag out timber at all seasons except during the hot-weather months. The trees were either drawn to the roadside and then sawn up into sleepers or, if the material was of first quality, it was carted to Alipur. Schlich's Working Plan prescribed that 5520 trees should be felled per annum. The average number of trees cut annually up to the time of Brandis' visit was only 2800, whilst numerous logs were lying on the roadside and large quantities of timber remained in the forest ; for instance, in Compartment VIII, where 1742 sâl trees had been felled, 1200 logs still remained in the forest, and in Compartment X 1400 logs out of 1623 trees felled. These were 1876-7 fellings, and in addition there were the fresh fellings of 1878-9. Brandis issued instructions to defer further fellings until all the timber in the forest should have been removed, and that in future the fellings should be regulated by the

possibility in annual extraction. Another reason for postponing fellings was that the project to construct the Rungpur to Dhubri Railway, for which large indents of sleepers had been made, was deferred. Timber was, however, wanted for the Kawnia-Kurigraon tramway. In addition to the old depot at Alipur, sale depots for Buxa timber had been established at Gachidanga on the Kalajani River and at Kawnia on the Tista River (the sleepers being floated down the Brahmaputra River and then taken 50 miles up the Tista to Kawnia). Another depot had been established at Dacca, although of this latter Gamble subsequently wrote that the second-class Buxa sâl timber sent there could never compete with the magnificent sâl from Nepal. Some 1000 *sissu* trees had been cut, but only 200 logs had been dragged from the forest and the demand for that timber was limited. Efforts were to be made to interest Calcutta merchants and the Ordnance Department in this timber. Its quality was, however, held to be inferior to that of Oudh. The whole of this work was departmental. Purchasers were allowed to remove dry timber on payment, a girth limit of 5 feet being fixed, above which no tree could be sold. Brandis pointed out that this restriction was wasteful because, in areas where no departmental operations were being undertaken, the larger trees rotted and their value was thus lost. A special rate should be fixed for logs over 5-feet girth and the Divisional Officer be empowered to sell them to purchasers. He also suggested that an attempt should be made to sell some of the other species associated with the sâl or *sissu* in these forests, to be tried as railway sleepers.

The financial results of these Divisions are of interest. From 1874-5 to 1876-7, before the separation of the two Divisions, there was a deficit, the receipts and expenses in 1874-5 being Rs.19,784 and Rs.23,513, and in 1876-7, Rs.15,534 and Rs.54,726. In 1877-8 the two Divisions were formed. For Jalpaiguri the receipts in 1877-8 were Rs.12,580 and expenses, Rs.16,545, and in 1879-80, Rs.10,417 and Rs.11,593. For Buxa the figures were Rs.37,153 and Rs.50,658 for 1877-8 and Rs.64,351 and Rs.56,089 for 1879-80. The greater expenditure in Buxa was due to the departmental working.

The Kurseong Division.—Before 1877 the Kurseong, Tista and Darjeeling Divisions formed one Division, and this accounts for the little real progress which had been made with fire protection and other matters, the charge being far too large. The Kurseong Division was formed by separating from the

Darjeeling Division most of the forests below, roughly, the 4000-foot contour in the Himalaya and including the forests out in the plains at the foot of the hills. Brandis' main pre-occupation in Kurseong was fire protection, and he suggested, as was his custom, that it was best to commence by first protecting effectively the most important forests, the remainder being safeguarded so far as possible by burning exterior and interior grass-lands. Here he selected for efficient protection the Bamunpokri Reserve (1372 acres) and part of the Sivoke Forest (10,170 acres), consisting of the blocks: Sivoke and Shammar-Danga sâl forest, the Champasari Forest, the Mohurgong and the Rangamatti. As the chief danger in this country (with the buttress of the Himalaya to the north) was from the south, the protection of the above blocks would effect the protection of most of the hill forests to the north of them. The great danger to the Sivoke block was, one common in India, from the privately owned Baikantpur Forest situated to the south of it which was burnt yearly, the prevailing southerly winds invariably carrying the fire into the Government Forest. This being the position, and the southern boundary of the forests of the division being recognized as the main danger-point, Brandis and Gamble enunciated very clearly the steps which were to be put in hand to introduce an efficient protection. The annual estimated outlay for this work was Rs.42½ per 1000 acres.

The chief revenue in the Kurseong Division at this time was obtained from sâl timber in the lower forests. The number of trees cut departmentally between 1877-8 and 1879-80 amounted to 2236, whilst for the same period 339 were cut by purchasers on permit, or 858 trees average per annum. As regards finance, it was not possible to separate the accounts of the three Divisions before their formation. For the three years 1877-8, 1878-9, 1879-80 the receipts were Rs.98,451, Rs.35,244 and Rs.40,047 respectively, whilst the expenditure was Rs.45,930, Rs.37,836 and Rs.30,354. In 1878-9 a sum of Rs.63,492 was paid for the purchase of certain lands in the Terai; this charge being a capital one is not included.

The Darjeeling Division.—The first commencement of conservancy work in the Bengal Forests began in the Darjeeling and Tista Forests (*vide* I, Chap. XXVII and II, Chap. XI). The importance of the forests of the Darjeeling Division had already become appreciated owing to the considerable demands for produce made by the station of Darjeeling, to the want of

adequate communications to the more distant forests and the over-cut condition of some of the more accessible ones, especially the Municipal Forests of Ghoompahar. The proposals made by Brandis during his visits at this period are therefore of interest; the more so since they may be considered to be the forerunners of one of the first detailed scientific Working Plans made for an area of forest in Bengal—that made by Mr. F. B. Manson in 1893.

In 1880 the Darjeeling Forests were divided into three ranges, Rangbul, Takdah and Ghoompahar. The area of the Rangbul Range was 4633 acres, divided into the five blocks: Duterea, Rangbul, Sonada, Chattackpur and Sepoydura. The Takdah Range (7862 acres) consisted of the six blocks: Senchal, Rangirum, Pomong, Hum, Takdah and Rangbi, whilst the Ghoompahar Range (8468 acres) had eight blocks: Pobong, Rishihat, Chongtong, Balasan, Palundong, Pagraingbong, Rangbong and Parmagiri.

It is stated that the chief task of the Darjeeling Forest Officer was "to supply the station of Darjeeling and the cantonment of Jalapahar with timber, firewood and charcoal. Eventually many tea plantations will draw their supplies from the Government Forests; but at present most of them supply themselves from their own lands, from Sikkim and from the land held by the Tchebu Lama. A few plantations, however, have already commenced obtaining charcoal from the Government forests. But the requirements of Darjeeling are the chief item, and it is necessary to consider how the working of these forests should be organized in order, permanently, to satisfy these requirements." Perhaps one of the chief sources of interest in perusing these old Reports on forest organization is the conviction forced upon one of the inability of the Forest Officer of those days to realize the future possible demands upon a forest area which would arise with an increase in population and their requirements, and, even more, with the appearance of new demands. In the case in question the possible future requirements of the tea planter were very far from being grasped. But in the history of forestry throughout the world during the past century we find, even in countries like France and Germany, the same inability of the Forest Officer to look forward and anticipate, and therefore prepare for in time, the enormous demands which the twentieth century will make upon the world's forest resources.

Of the above total area of forest in the three ranges it was

estimated that the requirements of Darjeeling could only be supplied for the present from the first three blocks of Rangbul, the first three and parts of Rangbi in Takdah and the first two and a part of the Municipal Forest, which was to be made over to the Department, in Ghoompahar, a total area of 9384 acres. A part of this area was above 7500 feet elevation, where natural regeneration was very slow and uncertain, and where, therefore, the forest could only be worked on a very cautious selection system ; a second part lay between 7000 and 7500 feet, where reproduction, though better than at the higher elevation, was still very slow ; the part remaining, estimated at from one-third to one-half the whole area, was below 7000 feet, and here it was then considered regeneration could be generally counted upon, if other considerations were favourable. This region at the higher elevations is an exception to the general rule in India, that the greater the moisture the more vigorous the growth. Here the excessive moisture causes slow growth and uncertain reproduction above 7000 feet, a fact recognized and recorded by Brandis, but which appears to have been lost sight of, or not fully appreciated, by some later Forest Officers, if the records of subsequent Working Plans are studied. The area available, as above mentioned, was insufficient, but it could be added to by improved communications. The steam tramway (i.e. the little Darjeeling-Himalayan Railway) was under construction at this time and was expected to be completed in 1881. The completion of the railway would open out the Chattackpur and Sepoydura blocks, the latter to be reserved for the supply of the station of Kurseong. In 1878-9 a commencement had been made with the construction of a cartroad with the object of transporting wood from the Ghoompahar Range. Starting from Ghoompahar village a little more than a mile had been constructed. It was intended to extend this road to Lepchajagat as soon as possible, when carts would be able to penetrate the forest for nearly six miles, and this would then open out the Chongtong and Balasan blocks. A second road had been under consideration for some years previous to 1880. This was to proceed along the north-east slope of Senchal and the Takdah Ridge in order to benefit the tea gardens and cultivated lands in the Tista and Great Rungeet valleys, and to improve the communications with Kalimpong. It was designed to make this road wide enough for small carts to pass. When completed, so as to permit of cart traffic as far as Pomong, it would open a considerably

larger area of the Pomong block and the nearer portions of the Hum and Takdah blocks. The total additional area thus available added to the 9384 acres would give a total acreage of 12,257 from which the requirements of Darjeeling would be drawn. It was estimated that these later amounted to 350,000 cubic feet of solid wood per annum for fuel and charcoal, and 150,000 cubic feet of timber for building, or a total of 500,000 cubic feet of solid wood. The figures given in the Report of the number of trees cut in the forests during the three years previous to 1880 (after the separation of the Division from Kurseong and Tista) are rather misleading, since they admittedly include a number of so-called "trees" which were in effect the refuse from previous wasteful fellings, such as high stumps, broken stems, etc; and dry wood. But Brandis rightly insisted that in the future an effort must be made to limit the number of trees felled and to obtain a large portion of the supply of wood and charcoal by utilizing stumps, roots and dry wood lying in the forest, as only by those means would it be possible to supply the estimated amount of 500,000 cubic feet per year from the prescribed felling of 2500 green trees. These trees were unlikely to produce more than 100 to 150 cubic feet of wood apiece. The rest would have to be made up by utilizing dry wood and stumps; and he suggested that an experiment should be made to break up large stumps with dynamite and to introduce the saw instead of the axe. The Department should employ a small staff of sawyers, and "this will probably induce the contractors engaged on this work to employ sawyers, in order to do their work more economically." The areas from which the amounts of materials were to be obtained were all situated below 7500 feet, and a cutting plan was drawn up by Brandis and Gamble in which the area over which the annual fellings to be made varied in the different blocks with the condition of the growing stock, aspect, gradient, prospects of reproduction and so forth. The estimate drawn up shows that in the three ranges it was considered that there were 2585 acres above 7500 feet and 9672 acres below, and that on this area 185,000 trees would be available for felling—62,500 in Ghoompahar, 95,000 in Takdah and 27,500 in Rangbul, all below 7500 feet elevation. Ghoompahar was to be cut out in twenty-five years, Takdah in thirty-eight years and Rangbul in eleven years, or seventy-four years in all, at the end of which period it was considered that this area would no longer contain any mature growing stock fit for felling (unless it were

in forests above 7500 feet). It was hoped, however, that by then (i.e. by 1954) communications would have improved and more distant forests would be available for the supply of Darjeeling. It was correctly insisted upon that the opening out of communications was vital.

The question of natural reproduction received careful consideration, as it would be sure to do from two such distinguished botanists as Brandis and Gamble. There were blanks and devastated areas in the blocks to be worked in, and these were to be planted and artificial work was to assist natural regeneration, since the felling plan appears to have contemplated a form of felling in bands or strips, or at any rate that all young vigorous growth should be left in bands and strips in addition to protective belts against wind. So far, planting operations had not proved successful in the Darjeeling Hills, and they were termed by Brandis to be still in the experimental stage although they had been commenced fifteen years or so before. They were to be limited to the lower elevations, but as Gamble had already stated in an earlier Annual Report, one of the difficulties was to be attributed to the fact that the supply of seed could not always be depended upon, a fact (according to the latest Working Plan) which worries present-day Forest Officers in these forests. Brandis remarked: "The Oaks do not seed every year, but only at irregular intervals. Chestnuts, Magnolias, *Bucklandia* (*pipili*) and Toon seed more regularly; but, as Mr. Gamble explains, the seed is often worm-eaten. Even of Maple the seed is scarce occasionally." This question of restocking the forests of this Division, many parts of which were wastefully exploited during the early periods in the history of the station of Darjeeling, was to remain a difficult problem for many years to come.

The first detailed Working Plan for the Division was drawn up by F. B. Manson and came into force in 1893. Its main provisions were the removal of half the standing crop and artificial restocking the area, the remainder of the old crop to be felled fifteen years later. This plan was in force at the close of the period. The station suffered from terrible slips in September, 1899, all the roads being closed. Fortunately the Department had a reserve of charcoal in the old depot. There was almost a wood famine, and the author, who was in charge at the time, was able to dispose of some of Manson's coupes which contractors had refused to purchase previously owing to their inaccessibility.

The Tista Division.—In 1877 this Division was formed from a part of the old Darjeeling Division. It comprised the forests in the valleys of the Tista and Great Rungeet Rivers and in the Daling Subdivision of the Darjeeling District. In 1878, under the orders of the Bengal Government, the lands in the latter Subdivision were divided into three main tracts : agricultural for native cultivators, Forest Reserves and tea lands. Within the forest lands areas were to be reserved for Cinchona cultivation.

The forest areas within the Division were divided into two main classes : (1) those below 3000 feet elevation in the valley of the Tista and its feeders, in which the sâl was the principal species ; (2) those above 3000 feet outside the sâl belt. The reasons for maintaining these forests, as given by Brandis in 1880, are of interest ; for they indicate the views held as to the lines of possible development of this tract east of the Tista River. He wrote : " Broadly speaking, it may be said that the chief object in maintaining and improving the lower forests is to produce timber for export and for the requirements of the tea plantations ; whilst the forests at higher elevations must be chiefly regarded as a Reserve, which will be useful when the valleys east of the Tista River have become completely cleared and cultivated. A large portion of the higher hills, particularly those in the eastern part of the district, near the Jaldaka River, are so steep and stony that, if once cleared, the forest is not likely to grow up again. Therefore, unless maintained under forest, there is much risk that they may become entirely denuded and unproductive."

Owing to the considerable area of country under tea gardens in the hills west of the Tista the Government of Bengal had refused to allow its extension in the hills to the east of this river, the Resolution on this head laying down that the culturable areas to the east should be reserved for the Lepcha and Nepali agricultural population.

Up to the year 1880 the area of Reserves demarcated and reserved under the Indian Forest Act comprised 42,015 acres, which included the forests in the Tista and Great Rungeet valleys, the Dumsong Block and the forest at the head of the Rilli and Mayrong streams. It was also proposed to transfer, from the Kurseong Division to the Tista, a part of the forest on the hills above Sivoke which overhang the west bank of the Tista River. In addition a large area in the outer hills between the Tista and Jaldaka Rivers and on the higher ranges in the

eastern part of the district had been notified under Section 4 of the Act with a view to their being eventually included in the Reserves. From the Nar Cher and Noam Blocks within this area land was to be made available for the extension of the Government Cinchona plantations under an arrangement contained in a Memorandum dated 30th October, 1878, drawn up between the Conservator of Forests and the Superintendent of the Royal Botanic Gardens, Calcutta. Under this agreement the Superintendent might select at any time such areas as he required, which were to be made over to him immediately. He was also to be allowed to cut down, free of charge, timber or firewood he required for the gardens on tracts made over to him, but the sums obtained from any produce sold should be credited to the Forest Department. If he required any produce from outside such areas as were selected for extension, but still within the two blocks, such trees were to be previously marked by a Forest Officer. The Superintendent undertook, so far as was feasible, to endeavour to make his first selections for extension in the Nar Cher block.

It will be obvious from the above description of the position that a considerable amount of demarcation work still remained to be carried out, and Brandis suggested that if an officer could be made available this work could be finished in two working seasons. Otherwise the work would have to be gradually completed by the Divisional Officer. From the area proposed to be reserved several tracts occupied by cultivators would have to be excluded, such as the plateau of Gorubatan east of the Chel River, occupied by Nepali cultivators, the Mangshing village at the head waters of the Rangjang stream, occupied by Lepchas and Nepalis, and ample areas of forest should be left for their requirements. He noted upon the considerable extension of cultivation round Kalimpong (the headquarters station of the Division) and in the Rilli and Mayrong valleys, since they became British territory after the Bhutan War (I, p. 515). In fact the Forest Officer, as the pioneer in the van of progress and civilization, had already accomplished wonders in these hills, although fifteen years had scarcely elapsed since the war, and still greater progress was to be made before the close of the century, as the writer, who held charge of the division between 1895-7, can personally vouch for. The Division was constituted into four ranges: the West Tista, including the forests on that side of the river, headquarters at Peshok; the East Tista, comprising the forests on the eastern

bank of the river and the Dumsong Block, headquarters at Kalimpong; the Chel Range, the forests on the outer hills between the Tista and Chel Rivers, headquarters at Chumbatti; the Pankasari Range, the forests in the eastern part of Division not comprised in the above, headquarters not fixed. The flora of this Division is one of very great interest (I, p. 53). Brandis deals, in his Report, with some of the more important species of trees and their uses or possible uses, especially tea boxes. Since these matters are better understood to-day it will be unnecessary to follow him on this subject. Some of his remarks anent the sâl are, however, worthy of comment. In the valley of the Great Rungeet the sâl extends only a short distance above the mouth of the Little Rungeet River. The highest sâl forest in this direction, which, Brandis says, must have been very valuable, was sold in 1870 to the Takvar Tea Company and cut out. In the Tista Valley the mouth of the Rangpo marks the upper limit of the sâl. On the outer ranges, between the Jaldaka and Lehti Rivers, sâl is altogether absent. This is a most curious piece of foot-hill country. East of the Jaldaka and west of the Lehti the hills project a considerable distance into the Duars, forming a large kind of inland bay. The mixed forest within this horseshoe is very fine, dense and of a subtropical character, in which no sâl is to be found. The excessive moisture owing to the heavy rainfall within this area is, as suggested by Mr. E. Fuchs the Divisional Officer at this period, the probable reason for the absence of sâl. On many occasions the writer has ridden up into the hills from this bay and only rarely can he remember having done so without a streaming jacket.

As regards former fellings of sâl (*vide* Vol. II, p. 416), the sâl forests in the outer hills between the Tista and Lehti had been worked considerably for sleepers, and full-sized trees were only to be seen in inaccessible places in 1880. In the Tista Valley a few trees had been cut for bridges and other local requirements, but the only heavy felling was in 1866, when Mann cut a large number of trees. A small portion only of the timber then felled was exported, but the remainder had since been removed. This felling did not extend far up the valley. Since then a good deal of timber from the Mungwa and Peshok Blocks had been cut and used in the construction of the Tista Valley Road and Bridge, and in 1876 trees were cut by Mr. Bonham-Carter and converted into narrow-gauge sleepers for the Northern Bengal State Railway. No departmental

fellings had ever been made in the valley of the Great Rungeet, of the Rilli or on the east bank of the Tista above its junction with the Rilli, but a number of sâl trees had been sold from time to time for making dug-out canoes, etc. On the outer hills the timber was dragged down the hills by coolies, drawn by elephants to a cart road and carted to the Phulbari depot and floated down to Jalpaiguri tied to boats. From the Tista Valley the sâl was floated tied to a cradle of bamboos and thus brought down to Sivoke. No estimate of the number of mature sâl trees remaining at this period in the Tista and Great Rungeet valleys could be formed. The size of the trees was considerable, and Brandis gives the measurements of one measured in a forest belonging to the Glenburn Estate in the Great Rungeet Valley as follows: total height, 161 feet; height to first branch, 86 feet; girth, at 4 feet from ground level, 10 feet 8 inches.

On the subject of grazing the Inspector-General pointed out that the upper level of cultivation in these mountains is, as on the Darjeeling side, about 6000 feet. Above this level the hills should be kept under forest for protective purposes. The high-level forests in the Tista Division would form about half of the total area of the demarcated forests when the work had been finished. The conditions on the east were, however, different to those on the west of the Tista. The high-level forests on the Senchal, Ghoompahar and Takdah Ranges were, as has been shown, required for the supply of produce for Darjeeling and the tea plantations. On the east side there was no large station and there would be no tea plantations. The high-level forests, Brandis considered, would, in addition to protection, find their chief utility in supplying the requirements of the local population, the principal one being pasture. In an order by the Bengal Government of November, 1878, it was decided that the cultivators who had settled east of the Tista should graze the cattle required for their domestic purposes free of charge in certain blocks of forest. This permission was not given as a right, and was only extended to cultivators, not to breeders of cattle, the latter being required to pay in the ordinary way. Nine blocks of forest were assigned for this purpose comprising nearly the whole of the forests, demarcated or proposed, above 3000 feet elevation. Half of each block was to be kept open for grazing, the Conservator to decide which part should be kept open. As had been so often the case elsewhere in the past, the permission was being already

misinterpreted ; for, in a letter from the Deputy Commissioner to the Commissioner of the Division, dated 26th July, 1879, the former wrote : " The Settlement Officer proposes to grant cattle used for tillage (and not cattle belonging to graziers or milkmen) the *right of free grazing* in certain forests." Brandis goes into the matter in great detail, giving his reasons for the selection of certain blocks to be closed and others to be opened. His main points were : (1) that he deprecated the introduction of a system of opening and closing these hill blocks in rotation as it would lead to inconvenience and difficulties ; (2) in order to prevent all misapprehension of the intentions of Government he advocated that a small fee should be paid for grazing ; (3) that the blocks open to grazing should be protected against fire, lopping and cutting of saplings. The only method under which this was possible was to assign definite blocks to each Mundel or headman of a village or villages and hold him responsible. If fires or damage occurred the block would be closed.

One of the difficulties in the management of this Division was, and remained for some time, the question of finance. Little revenue was realizable. In the three years since it had been formed there had been a total deficit of Rs.30,000, the total revenue of the period having been Rs.10,000. Brandis drew up a forecast for the next five years. On the assumption that 3000 acres were stocked with good workable sâl forest, it was estimated that an annual yield of 300 sâl trees would be available, producing Rs.6,000 revenue, and with a little revenue from toon and minor products a sum of Rs.6,450 should be realizable. Fees for grazing of cattle at 8 annas per head should produce Rs.2,000, and with fees for other local produce a sum of Rs. 7,050, making a total revenue of Rs.13,500. The total charges were estimated at Rs.15,900, leaving a small deficit—an interesting forecast of a budget. For the above reason it will be easily understood that the proposal to divide this Division into two—the Tista and Daling Divisions—had been turned down as impracticable for financial reasons.

Ribbentrop (" Review of For. Administra. Br. Ind., 1884-5," p. 3) wrote that much still remained to be done to acquire further Government Forests in Bengal. The proportion of Reserved Forests was still only $3\frac{1}{4}$ per cent of the whole area of the country, and the great bulk of the Forests lay in remote parts of the Province. The country was thickly populated



EXAMPLE OF BUTTRESS FORMATION ON *TORRICELLIA TILIAEFOLIA*. DOHING
RIVER, 400 FT. LAKHIMPUR, ASSAM

M. Jacob, photo.



NATURAL REGENERATION OF MAHOGANY FROM MOTHER TREES SOWN ABOUT
1875 AT KAPTAL, CHITTAGONG HILL TRACTS, BENGAL. THE PARENT TREES
ARE STILL STANDING

and very large areas were absolutely without forests under Government control.

Of the other Divisions Chittagong had made some progress by the end of the century, and would have made still more had an adequate staff been available. The Division, the greater part of which had to be visited by water, was unwieldy. It consisted of two main portions. Some small detached blocks of Reserves situated in the Chittagong Collectorate containing bamboos and grass as their chief products, the demand for which was large. The rest and greater part of the forest area consisted of the unclassed forests in the hill tracts. These were being worked on the old system—the hill people cut out timber, bamboos, canes, etc., made them into rafts and floated them down the rivers, royalty being paid at the toll stations. At this period revenue was the chief preoccupation of the divisional officer.

In the Singbhum Division there was little work of interest taking place: protection, fire work in the hot weather and the marking for sale of a few hundred sâl trees formed the chief work of the Forest Officer up to 1896. Additions had been made to these forests in 1884-5 and subsequently. When the Bengal-Nagpur Railway was driven through the heart of the forest, between Porahat and Saranda, in the late eighties, the Department apparently tried to obtain too high a price for its sâl timber and the line was sleepers with iron pot sleepers!—and is so to the present day. A later opportunity was not let slip. In 1896 Hill, who was officiating as Inspector-General of Forests for Ribbentrop, obtained a Government contract to supply 2 lakhs of sâl sleepers from Singbhum and some of the magnificent old growing stock from Saranda and other parts at length fell beneath the axe. These sleeper works were a great help to Bengal in the years 1895-6 and 1896-7. In the Inspector-General's Review of Forest Administration for the latter year he remarks (p. 39): "The operations for the supply of sleepers to the Rae Bareilly-Benares Railway continued in Singbhum, where the output was 538,972 cubic feet, and Mr. Wild (the Conservator) points out that it was only these operations that enabled the Circle to maintain its financial position during the year, which the prevalence of drought and scarcity in the Sundarbans and Chittagong (these being the Divisions which usually yield most profit) would have otherwise endangered." The first Working Plan for these forests was

prepared by Mr. H. H. Haines towards the close of the century.

In the Sundarbans further additions had been made to the forest area by the gazetting in 1878-9 of 1925 square miles as Protected Forests. Of this 1875 square miles were in the 24-Pargannas, and 50 square miles in the Jessore District. With reference to this area Brandis wrote ("Review of For. Administr., 1878-9," p. 18): "The land included within these protected forests will, under definite rules, be available for the extension of cultivation, but Government retains the control of the forest growth upon it, until it is actually cleared and brought under the plough. The same revenue will be paid upon the wood and timber exported from such lands as is paid upon the wood and timber exported from the remainder of the protected forests." The demarcation of the large area of these Sundarbans Forests had presented little difficulty, since the boundaries were water ones and the area intersected with river channels and tidal "khals," which rendered the subdivision for working purposes a facile matter. An efficient organization was gradually built up and a Working Plan was prepared. Theft was one of the great sources of trouble in the management of this Division.

In 1899-1900 the total area of forests under the Department amounted to 13,589 square miles, of which 5881 square miles were reserves, 3675 square miles protected, and 4033 square miles unclassified (Chittagong Hill Tracts) forest (8.87 per cent of province). Of this area 5320 square miles were under Working Plans or plans were in course of preparation. The revenue for the year amounted to Rs.11,38,910, with an average of Rs.10,49,364 for the preceding five years; and the surplus to Rs.5,93,700 the preceding five years average being Rs.5,10,712.

CHAPTER X

FOREST OPERATIONS IN ASSAM, 1871-1900

ONE of the anomalies of the introduction of Forest Conservancy into India, as this history will have already shown, was the very varying condition of the forests and of the nature of the civil administration. Assam in 1870 forms a typical example. This area was not at that time an independent Province. The Central Provinces had been in a similar position in 1860 (I, p. 392). Assam was governed by a Commissioner under the orders of the Government of Bengal. Conservancy at this date had not been introduced and the first complete published Memorandum on the forests of Assam was included in the Bengal Report of 1869-70, as mentioned in Volume II (p. 426).

Before describing the introduction of Forest Conservancy in this area during the period under review, it will be of interest to deal briefly with the history of the forests previous to 1870. The first mention made on the subject of conserving the forests was in the year 1850. The Collector of Kamrup reported to the Commissioner that wood-cutters belonging to Bengal had now made their appearance in Kamrup in quest of sâl timber, the sâl forests in the districts lower down the Brahmaputra having by then been exhausted by indiscriminate and unchecked fellings. The Collector suggested that a tax should be levied on all timber felled instead of allowing the timber contractors to fell where they pleased after having paid unauthorized cesses to the Fiscal Officers, which was at that time the practice. He also advised that a check should be established on the felling of young trees of valuable species in order to prevent waste and ensure the regeneration of the forests. The tax proposed was a small one of Rs.15 per 100 logs, or nearly 2½ annas a log. The income from the new tax was estimated to realize from Rs.500 to Rs.600 annually. The suggested tax was intended to supersede the one established in the previous year upon timber cut in the Garo and Khasi

Hills and floated down the Singri and Kulsi Rivers. These proposals were approved by the Commissioner and by the Deputy Governor of Bengal. In 1852 this system was abolished by the Board of Revenue and they introduced the policy, which, as has been shown, was common in other Provinces of India, of farming certain tracts of forests to the highest bidder for periods of five years. The Board expressed its opinion that the farmers should be left at liberty to work the forests as they pleased, and intimated that the question of cutting trees of certain sizes only and the prevention of the destruction of the young trees could be left for future consideration. These conservancy matters, they said, could be considered, "after the forests had been more cleared!" By 1861 this system had been extended to the Nowgong and Darrang Districts, as the timber contractors moved higher up the Brahmaputra. In 1863 the Commissioner recommended that the above system of farming should be continued in the forests of Kamrup. He stated that there was little or no timber of any value in Sibsagar, and he added that orders had been issued for the levying of a certain scale of fees on logs of varying lengths in Nowgong, Darrang and Lakhimpur, and that the Fiscal Officers were instructed to protect the forests from spoliation and to prevent the felling of small trees of certain noted species. This was a move in the right direction. The Commissioner at the same time suggested that the Nambor Forest should be preserved, and that Forest Officers should be deputed to select and conserve the better forests in Assam. This step had become the more imperative since forest land was best suited for tea cultivation, and the Deputy Commissioners were experiencing great difficulty in deciding which classes of forest land might be sold, or leased, for this purpose, and which should be retained by the Government.

It becomes apparent, therefore, that at this period Forest Conservancy in Assam did not exist, since the Fiscal Officers were the farmers and farmed the revenues of certain tracts on certain terms. In 1868 a new revenue system was introduced under which small tahsildars, who were here called Mouzadars, were appointed, and the forests and their protection were made over to their charge with the rest of the land. The preparation of a complete general map of all the forests in the Lower Provinces of Bengal had been ordered by the Government in this year. It was owing to the inability of the civil authorities to prepare such a map or to properly describe the

forests that an Assistant Conservator of Forests (Mr. Gustav Mann) was deputed for this purpose, as already mentioned in the previous volume. This inspection commenced at the Sunkosh River, the western boundary of the Province north of the Brahmaputra, and was carried out during the years 1868-9 and 1869-70, the results being recorded in the Annual Forest Administration Reports of Bengal for these years.

It was quickly realized that the new revenue system introduced in 1868 was very far from affording adequate protection to the forests or realizing the proper revenue from them. The Reports of the Assistant Conservator showed that in the valuable sâl forests of the Eastern Duars in the Goalpara District the Bengal wood-cutters were felling uncontrolled, and that the forests were being devastated, large quantities of partly used trees remaining on the ground, the total payment made being only Rs.4.4 per axe per year, being calculated at the rate of $2\frac{1}{2}$ annas per tree. This calculation was made from the timber-cutters' statements that each man brought out about fifty logs, and on the supposition that two logs were cut out of each tree, which was probably a very low estimate. That Government were not realizing the full revenue from these forests is evident from the fact that logs at this time fetched on the Brahmaputra Rs.10 to Rs.15 per pair. In spite of this fact, the Mouzadars, who were making a lucrative business out of it, said that it would be a very great hardship to the wood-cutters if the rate per axe were raised; and yet these men were nowhere restricted, and cut exactly what they liked both as to size, quality and quantity. In the Kamrup District matters were worse, for the greater part of the most valuable sâl forests had been made over to the Lower Assam Tea Company as waste land. In the Darrang District timber was charged at the above-mentioned rates, and the right of collecting rubber from *Ficus elastica* trees was sold to the highest bidder, or granted free, with the sole condition that new trees should be planted, and that rubber should only be collected between the 1st of November and the 30th of April. Since the Fiscal Officers were the only ones responsible for the carrying out of these conditions, the inevitable result was that the rubber trees were destroyed on a very large scale, either by over-tapping or felling; and that such young trees as had been planted were either placed along the roads or planted in the stations, no subsequent attention being given to them. The same state of affairs existed in the Nowgong District, the

few small *sâl* forests of that district having been so heavily worked that only small-sized trees were left in them, and the Public Works Department had no timber with which to construct the bridges on the Assam trunk road. In this district also some of the best *sâl* forests had been sold as waste land. The Sibsagar District had very little forest left anywhere. In spite of this, waste land grants had been sold in the Nambor Forests, the reservation of which had been repeatedly urged by the authorities. In the east of this district forest land had also been treated in a similar fashion. The Lakhimpur District was still covered, for the most part, with forests of the mixed evergreen type, a type which rapidly deteriorates under unchecked fellings. Two sawmills, Dehing and Dibrugarh, were working uncontrolled in these forests, the operations being carried out almost up to the door of the Deputy Commissioner's Headquarters; the Mouzadars, the persons who were supposed to be the guardians of the Government's interests, themselves supplying timber to the sawmills.

Such were the conditions pertaining to the accessible tracts of the Assam Forests at the period when the above-mentioned investigations were carried out by the Assistant Conservator. Forest Conservancy slowly dawned over the Province after this date, a special examination, with the view to selecting Reserves, being commenced in 1870-1, as were also experimental timber and plantation works.

At this period the different types of forest of the Province were classified as follows: (1) *sâl* forest, (2) *sissu* and *khair* forests, (3) mixed plains forests, (4) mixed lower hill forests, (5) pine forests, (6) mixed upper hill forests. These six types exhibit the varying nature of the Assam Forests, and, although the true recognition of their great prospective value came slowly, it had become already recognized that the forest property of the Government in Assam should, if properly managed, become a source of great value and revenue to the Province. It was stated at the time that the supply of timber, fuel and other forest produce, including grazing grounds for ryots, was so abundant in the Province that these materials were granted free, and that there would be no necessity for permitting access to the Reserves then being formed. One difficulty experienced by the Assam Forest Department, when it came into being, was due to the scarcity of manual labour, the population being very small. To obviate the difficulty

elephants were tried for dragging the timber. These animals, however, were expensive, and were found, in this Province particularly subject to disease, and it was soon suggested that buffaloes should be employed to a much greater extent.

The First Annual Progress Report on the Forests was drawn up by Mann in the year 1874-5. In this Report it is mentioned that in 1871-2 the Conservator of Forests, Bengal, who was responsible for the Assam Forests, had proposed a transfer of several thousands of square miles of forest in Assam to the Forest Department, without any previous demarcation or definition of the boundaries. This proposal did not meet with the approval of the Government of Bengal, who ordered the early selection and demarcation of the better forests as Reserves. These forests would be placed in charge of the Department, whilst the remaining forest tracts would be managed by the Deputy Commissioners, to each of whom a forest staff consisting of one officer at Rs.40 a month and four watchers at Rs.8 each would be allocated. The selection and demarcation of Reserves had made steady progress.

The Province at this period was divided into the following districts: (1) Brahmaputra Valley—Goalpara, Kamrup, Darrang, Nowgong, Sibsagar and Lakhimpur. (2) Surma Valley—Sylhet and Cachar. (3) Areas under political control only—Garo Hills, Khasi and Jaintia Hills, and the Naga Hills.

The Forest areas in the above districts were estimated at about 7800 square miles. This estimate did not, however, include extensive forest tracts in which numerous hill tribes were carrying on *jhuming* (shifting cultivation), and, it was said in the official papers, "must be permitted to continue doing so." The area of 7800 square miles included, however, "extensive forest tracts, at present untouched by the axe, but which eventually will, within the present revenue limits, have to be given up for tea cultivation and, beyond revenue limits, to *jhum* cultivation. The requirements of either it would be in vain to estimate at the present day."

Whilst in the interests of revenue and the encouragement of commercial undertakings the grant of land for tea cultivation within certain limits (here in Assam very far from having been approached at this time) was justifiable, the second contention showed a lack of wide vision which was deplorable. Mann could have had very little knowledge of the controversies of the past and the position which the shifting cultivation problem had reached in other Provinces when he enunciated the above

views. It was the more deplorable since the opinion he expressed, that the tribes were to be rather encouraged than weaned from their pernicious and wasteful destruction of the forests, was to prevail, both in Bengal and Assam, for many years thereafter.

A further area not included in the above quota is described as follows: "Again, the grass lands, with trees scattered over them more or less abundantly, which in a less fertile country might be considered forests, and have, even in Assam, been dignified with the name of savannah forests, are not included in the above estimate; if they were, the whole Province, except the cultivated area and rivers, might be designated forest. The Garo Hills have not been included in this estimate, since little, if any, of the forests remaining can be conserved, because the country is well-inhabited and the people live by *jhuming*, a stoppage of which would mean starvation to the people if it were attempted, and is not advisable for political reasons either at present."

Before considering the 1874-5 Forest Report, which details the position facing the new Department, it will be necessary to glance at the preliminary steps taken to inaugurate the Department. Assam had been formed into a Chief Commissionership under a proclamation published on the 7th February, 1874. The districts of Kamrup, Darrang, Nowgong, Sibsagar, Lakhimpur, Garo Hills, Khasi and Jaintia Hills, Naga Hills, Cachar (which came under British rule in 1830) and Goalpara were thus separated from Bengal and formed into an independent Province directly under the Government of India. In September of the same year the district of Sylhet was added. It is of interest to note that two invasions of Assam had been undertaken by the Burmese, the second occurring some years previous to the first Burmese War. As a result of the latter, Assam was ceded to the British by the Burmese under the Treaty of Yandaboo, February 24th, 1826 (*vide* Vol. I, p. 125). The only independent State in Assam was Manipur. The chief political relations and difficulties of the Province were with the frontier tribes. These consisted of the Bhutias and cognate tribes, the Akas, Dufflas, Miris, Arbors, Mishmis, Khampis, Phakials, Doanias, Singphos, Nagas, Mikirs, the tribes of North Cachar, Lushais, Khasias, Syntengs and the Garos. These tribes were more or less totally uncivilized and troubles broke out periodically. Expeditions had to be sent against the Nagas, who cut up a British survey party in 1875, and to punish a raid by the Dufflas in the cold weather of 1875-6.

In June, 1873, Mann submitted to the Commissioner a Memorandum on proposed forest operations in Assam. At the time Schlich, Conservator of Forests, Bengal and Assam, was touring in Assam and the Commissioner asked the Conservator if he would give him the benefit of his advice on the Memorandum. Schlich complied with the suggestion and drew up a Memorandum embodying his views regarding forest operations in Assam, dated 10th July, 1873. This Memorandum is of high interest, since it displays the position from which the whole matter was regarded by the Commissioner and the Conservator.

Briefly, Schlich's forestry proposals for Assam suggested the formation of additional Reserves to bring the total up to an area of 700 square miles, the rest of the forest areas being left entirely open, only sâl, rubber, and *soom* (*Machilus odoratissima*) being declared reserved trees. These proposals were discussed in his Memorandum, which will be now glanced at. Apart from the question of forest reservation, the chief questions of importance at this time were the formation of plantations and the methods of collecting and protecting rubber or caoutchouc.

Schlich records that the first step in forest conservancy in Assam was the reservation of the Nambor Forest in the Sibsagar and Naga Hills Districts during the time that Colonel Jenkins was Commissioner of Assam. No further work was undertaken till the first establishment of a Forest Department in Assam, in 1868. From that date till 1871, the Officer posted to Assam, under the direct orders of the Conservator of Forests, Bengal, was occupied in examining the country generally. This examination completed, the Officers were placed under the orders of the Commissioner of Assam, and the selection of Reserves was proceeded with.

The forest plantation work up to this time Schlich classes as only of the experimental order, undertaken chiefly with a view to seeing whether teak would thrive in the Province. The tree is not indigenous, but had been planted in several stations. Experimental plantations had been established adjacent to the Kulsi River (July, 1872), where it leaves the Khasi Hills, and at Makoom, on the Dehing River. Schlich was not enthusiastic on the subject of the success of teak. The Makoom plantation was already a failure. It was situated on level ground, about 15 feet above the river, with defective drainage. It had been commenced in July, 1869. The four-year old trees were 33 feet high and the two-year-old up to 16 feet. Numerous trees were decaying at the base of the stem and some had been attacked by a beetle, and the whole appeared to be doomed. Schlich thought that the cold dampness of Upper Assam was possibly against the growth of teak. An examination of the

trees planted in stations disclosed the fact that although they attained the girth (though very fluted in lower part of the stem) they would never be likely to reach the long clean height of bole of the Burmese teak. In noting this opinion, the Commissioner said that he did not think that this objection should rule out teak, since in Assam short thick logs would find plenty of uses and even be preferred by the people.

The Kulsi plantation was showing very much better results, the Burmese seed (of two ages, 1870 and 1872) being better than the local Assam teak seed. The site selected was a better one, consisting of an area of 8 square miles, of low hills, with low-lying land between them, the soil a mixture of loam clay and sand. Some seed was sown direct 6 feet by 3 feet, on July 7th, 1872, the rest being sown in the nursery on the same date. All the seed had germinated by the end of July. The transplants were put out 6 feet by 6 feet, between 1st and 14th September, the plants being about 3 inches in height. The area transplanted was $7\frac{1}{4}$ acres, which with the area sown direct made $8\frac{1}{4}$ acres of plantation. Schlich examined the area on 18th and 20th May, 1873. He stated that the area sown direct was the best, all the plants being vigorous. The next best was the piece from the Burma seed of 1872. The rest was not so good, but it was pointed out that the transplanting was done too late in the season, as rain ceased falling after the first week in September. The height of the plants ranged from a few inches to 2 feet. No cleaning had been necessary till April, 1873. Mr. Aylmer, Assistant Conservator of Forests, was the officer in charge. Schlich was not in favour of experimenting with exotic species, which the Commissioner apparently favoured, but suggested that the experiments at Kulsi should be continued and that the teak should be mixed with sâl, *Cedrela Toona*, and perhaps *Artocarpus Chaplasha*.

The Conservator does not appear to have been very optimistic as to the possibilities of the Assam Forests from the revenue point of view. He said that it was evident that Assam is provided with much more timber and wood than was likely to be required for local use for a long time to come. Of sâl, he remarked, there was still a sufficient quantity left to provide Lower Assam, and if it should be required, even Upper Assam. After alluding to the other timbers in the forests, and referring to the fact that the pine forests of the Upper Khasi Hills could be easily conserved and extended, if required, "by keeping *jhuming* and fires out of certain tracts should an increase of population necessitate them" Schlich continues: "The prospects of utilizing the surplus stock of timber by exporting it are slight, with the exception of sâl. The great bulk of good and rich forests is situated in Upper Assam, and, moreover, the greater portion of *sam* (*Artocarpus Chaplasha*) is found in remote places where very little labour is available. The consequence is that the expenditure in removing the timber is too high in pro-

portion to its value, none of the mixed plain and lower hill forest trees yielding really first-class timber." Even sleepers, if they could be creosoted from the pine forests of the Khasi Hills could not, he thought, compete with imported sleepers arriving at Goalundo. He considered, therefore, an export trade in timber from Assam at the time impossible; and the Commissioner agreed with him.

One of the most troublesome subjects in connection with the forests in Assam was the rubber question and its collection. Owing to the high commercial value of this article every excess was practised, from ruining the trees by overtapping and other malpractices, to smuggling the rubber. Since the rubber trees grew scattered throughout the forests, so far supervision had been impracticable, and, moreover, at this time the trees were supposed to be far more numerous in the forests beyond the British boundary than within it. Schlich sums up the complicated position as follows: "The system hitherto followed consisted of selling the right to collect rubber within certain limits. The purchasers of these rights assumed at the same time the exclusive right of buying up the foreign rubber imported into their *mehals* until the lucrativeness of the transaction attracted numerous speculators who very soon found out that the right as regards the foreign rubber was merely assumed. They set to work and bought foreign rubber in opposition to the Government lessees, who caused the rubber to be attached, brought cases in the courts and, in fine, the difficulties in dealing with the subject became so complicated and political complications with the hill tribes so imminent, that the right to collect rubber within British territory was not sold at all in 1873." Steps were now being taken to restrict the movements of British subjects and others beyond the frontier line. Owing to his ignorance of the conditions, Schlich naturally expresses diffidence as to giving any opinion, but says that there appeared to be three methods: (1) Allowing the collection to be free. (2) Creating a Government monopoly, which was apparently the Commissioner's own idea. (3) Levying a revenue on rubber by imposing an export duty, leaving the collection free. The quantities of rubber bought from Assam were 7500 maunds (1 maund = 80 lbs.) in 1870, 12,000 maunds in 1871, and 21,000 maunds in 1872. A tax of Rs.5 per maund, said Schlich, would bring in more than Rs.50,000, half of which could be expended in paying for establishing rubber plantations. This latter had already been suggested by Mann, and he had proposed as site an area of 200 square miles, covered with dense evergreen mixed plain and lower hill forest, situated in the Char Duar forest at the foot of the Himalaya, about 25 miles north-west of Tezpur. Both Dr. Henderson, Superintendent of the Botanic Gardens at Calcutta, and Mann had expressed their views as to the method of starting this plantation. Henderson proposed to plant

15 feet by 15 feet, three cuttings at each planting spot. At the age of from five to fifteen years, according to experience, tapping was to begin, each alternate tree to be tapped till it died, leaving the trees spaced 30 feet by 30 feet, each of which should yield as a minimum Rs.5 per annum. Mann proposed to clear lines 20 feet broad and 100 feet apart from centre to centre, and to plant cuttings 50 feet apart in the lines. As soon as the trees closed up every alternate tree in the line to be tapped to death. Schlich proposed a middle course between the two. He suggested lines 50 feet apart, each line to be 20 feet broad, the felled jungle, as proposed by Mann, to be pushed on to the uncut portion. As soon as the trees began to close, each alternate tree to be tapped to death. The respective number of trees in the final crop per acre under the three methods would be, therefore, forty-eight, nine and seventeen. With labour difficult to get, Henderson's closer planting would be expensive and impracticable, as the whole area would have to be taken in hand, whilst the trees grow to too large a size, the large trees existing in the forest occupying from $\frac{1}{4}$ to 1 acre of ground apiece. Schlich's method would only necessitate taking in hand two-fifths of the ground being dealt with. Schlich suggested raising the trees both from cuttings and from seed sown in nurseries, as there was no certainty that trees from cuttings would produce as fine trees as those from seed. Mann's estimate of the cost per acre was annas thirteen. Schlich thought about Rs.20 to start with, and later on Rs.10-12 per acre. One hundred acres were to be planted during the first year of the work.

On the subject of labour supply, the following extract from Schlich's Memorandum is produced, since it is worthy of being carefully borne in mind by the young Forest Officer of to-day, whilst it forms a worthy epitaph to a valued young officer who was to be so soon lost to the young Department in Assam.

"In Upper Assam local labour is not available, or only on a very small scale. In Lower Assam Mr. Aylmer has succeeded this year in making upwards of 30 acres of teak and small areas of rubber, toon and *sissu* plantations, entirely by local labour. This officer was the first who succeeded in Burma in drawing labour to the teak plantations by paying the current rate to every coolie who came, and by giving the men perfect liberty to go again when they liked. During the present year he has adopted the same system in Assam, and the result is that he has quite as much labour as he wants: in fact the men are only afraid of being discharged for want of work. It is true that the happy way in which Mr. Aylmer treats the men has much to do with his success, and perhaps not every officer would be equally successful."

The other question which Schlich considers is in connection with the *soom* (*Machilus odoratissima*) (*bombycina*?) forests and the silkworm industry. Silk was manufactured in Assam from the cocoons of

several species of wild silk moths. The caterpillars fed on a variety of trees which were artificially raised, with the exception of the "soom" tree in Middle and Lower Assam. The caterpillar of the moth (*Antheraea assamica*, the *muga* worm) feeds upon the "soom" leaves. This tree was spread over some 300 square miles of forest. The Commissioner gives the area as 63 square miles (Letter No. 48, of 20th February, 1873, to Government of Bengal), of which about 28 square miles were assessed, yielding an annual revenue of Rs.27,875. The Commissioner's area did not, however, include that in the Lakhimpur District, estimated at 200 square miles. The out-turn of silk was estimated at 101,940 lbs., the number of people employed in the manufacture as 43,800. As the area of forest then in use for cultivation was small, Schlich did not consider that the Department should interfere; the revenue might still be collected by the Revenue Authorities; but, he added, that as this product came from the forests it should be credited as forest revenue. To this the Commissioner took the strongest objection, stating that as the Revenue Authorities had created the industry they should benefit by the results of their labours. To this contention Schlich's retort that the Revenue officials had found the industry already in the country and had merely collected a revenue from it was unanswerable. Small difficulties of this kind had, as has been already shown, been common in other provinces and were inevitable with the uprising of a new Department.

A return will now be made to a consideration of the 1874-5 Forest Report, from which it will be possible to review the progress made on the lines laid down. At the time of the separation of Assam the forests of Cachar, then constituting the Dacca Division of Bengal (*vide* Vol. II, p. 398), were transferred to Assam. In September, 1874, the forests of Sylhet (Vol. II, p. 396) were also transferred to Assam, and formed, with the Cachar Forests, the new Division of Cachar of Assam. As has been said, the first Annual Administration Forest Report for Assam was drawn up for the year 1874-5. In that year the Chief Commissioner sanctioned the following five Forest Divisions for the Province: (1) Goalpara, (2) Gauhati, (3) Tezpur, (4) Golaghât, (5) Cachar. The following description of these five Divisions, from the knowledge available at this period, is given in the above-quoted Report.

"The Goalpara Division comprises the Government open forest in the Eastern Duars of the Goalpara District, covering an area of 422 square miles, out of which about 80 square miles are sâl forest, the contents of which were estimated by the Conservator of Forests, Bengal, last year, at 2½ millions of sâl trees, and, if properly protected, an annual yield of 25,000 sâl trees. This, no doubt, is the

most valuable State property, as regards forest, in this Province. Any forests which it may hereafter be decided to conserve in the Gâro Hills will form part of this Division. The headquarters of the Officer-in-Charge are at Goalpara.

The Gauhati Division comprises the Forest Reserves in the Kamrup District and the western half of the Nowgong District, all of which are sâl forests, which have been demarcated and mapped, and extend over an area of 50·76 square miles. This Division also includes the experimental rubber, teak and *sissu* plantations at Kulsi, which are the headquarters of the Divisional Forest Officer.

The Tezpur Division comprises the Forest Reserves in the Darrang District, covering an area of 179·59 square miles, out of which only 1 square mile is sâl forest, all the rest being mixed lower hill and mixed plain forest, with about half a mile of *khair* Forest in the Khaling Duar Reserve, near the western boundary of the District. The above area includes the Nowduar Reserves of 82 square miles, placed in charge of the Forest Department, but not as yet gazetted, on account of the unsettled boundary between the Akha Hills and Assam. This Division includes the Charduar rubber plantation. The headquarters of the Divisional Forest Officer are at the Bhairabi ghât, a distance of 5 miles from the Charduar rubber plantation, to ensure competent supervision for this work throughout the year.

The Golaghât Division comprises the Nambor Reserve of 389½ square miles in the Sibsâgar and Naga Hills Districts, and the Mikir Hill Reserve of 65 square miles in the eastern half of the Nowgong District. All the forests in this Division are mixed lower hill forests, and 326 square miles of the above area, added during the year to the Nambor Reserve, are managed by the Officer-in-Charge of the Golaghât Forest Division, under the orders of the Political Agent, Naga Hills, and the Deputy-conservator of Forests conjointly. The headquarters of the Divisional Forest Officer are at Golaghât.

The Cachar Division comprises an area of 825 square miles, in the Cachar District, and 273 square miles in the Sylhet District, which it has been proposed to declare Reserves under Act VII of 1865, to be managed by the Divisional Forest Officer, under the orders of the Deputy-Commissioners and those of the Deputy-Conservator conjointly. The headquarters of the Divisional Forest Officer are to be at Silchar."

Mann's Report is characterized by four excellent appendices, the first giving a list of trees of the Province (with their scientific names), divided into those growing in the Brahmaputra Valley and those in the Khasi and Jaintia Hills in the mixed upper hill forests. The second appendix gives a Register of Reserved Forests as existing in the Province on April 1st, 1875. These were as follows : Gauhati Division : Kamrup District—Reserves—Barduar, Pantan ; Nowgong District — Kholahat, Deboka, Matiakhar, Kulsi teak

plantation, Jara Sâl, Milmillia. Tezpur Division : Darrang District—Balipara, Khaling Duar. Golaghât Division : Sibsagar District and Naga Hills Agency—Nambor ; Nowgong District—Mikir Hill. Appendix 3 deals with " Rules for the better management and preservation of the Reserved Forests in the Naga Hills Territory " ; whilst Appendix 4 is a " Statement showing the result of an examination of the concentric rings of thirty-two sâl trees in the Balipara Reserve." This latter is by W. R. Fisher, subsequently well known both at the Dehra Dun Forest School, and later as Assistant-Professor of Forestry under Sir W. Schlich, at Cooper's Hill.

The Report shows that in Mann, Assam had an energetic and practical Forest Officer. The Province lost Aylmer, who died at the close of the year, on his way home.

Timber generally, except sâl and *sissu*, was plentiful, but it was subject to the same disabilities as elsewhere in the country—the prejudice against using anything but sâl and *sissu*. In the Brahmaputra Valley the trees were either sold standing in the forest, at specified rates, or the timber was brought to depot by the Department. The species which were not free and on which royalties were charged were divided into two classes, as follows :

First class : *Shorea robusta*, *Dalbergia Sissoo*, *Mesua ferrea*, *Lagerstrœmia Flos-Reginæ*, *Artocarpus Chaplasha*, *Cedrela Toona*, *Michelia Champaca*, *Cinnamomum glanduliferum*, *Bischofia Javanica*, *Shorea* sp., *Albizia odoratissima*, *Chikrassia tabularis*, *Terminalia bicolorata*. Second class : *Eugenia mangifolia*, *Eugenia Jambolana*, *Gmelina arborea*, *Salix tetrasperma*, *Morus lævigata*, *Schima mollis*, *Acacia Catechu*, *Michelia oblonga*, *Echinocarpus tiliaceus*, *Castonapsis tribuloides*, *Terminalia citrina*, *Terminalia tomentosa*, *Cassia Fistula*, *Altingia excelsa*, *Pithecolobium bigeminum*, *Stereospermum chelonoides*.

The market value of sâl in depots varied from 12 annas to R.1 per cubic foot ; other timbers brought to depot (on indent only) by the Department were sold at 12 annas per cubic foot. Timber from the Cachar Forests was paid for at the toll-station of Sealtek ghât according to size and kind of the logs (*vide* Vol. II, p. 402).

Mann has the following interesting notes on the forestry position generally at the period as he envisaged it :

"As regards forest legislation, Assam feels the want of a more extended Forest Act and more detailed forest rules, perhaps less than any other Province in India, since, with the exception of one small village in the Nambor Reserve, no rights or privileges of the inhabitants exist in the Reserves, and forest produce and grazing grounds are so abundant all through the Province that it would be trifling with the Government interest to give ryots access to the Reserves. This may also be said, generally speaking, in regard to those areas yet to be selected as Reserves. In the as yet undefined

forests under the Deputy Commissioners it is very much the same, since there are areas in excess of any possible requirements for the Province itself, from which even the open forest can be selected without the necessity of permitting cultivation or grazing in them.

What is necessary and urgent is that none of the better forests are given up at all for cultivation, until the Government Forests, both reserved and open, are demarcated, and that this work is carried out with as much expedition as practicable, since without this there is always great danger in Assam of encroachment on the forests by temporary cultivation and alienation of Government Forests by sale or lease, according to the views the respective Deputy Commissioners take of the necessity for forest conservancy, and their knowledge of the forests in the Districts. The chief reason that Deputy Commissioners have given so little support to forest conservancy is that they do not understand it, and the great influence it has on the welfare of the people. Neither have they had any special inducement to acquire such knowledge, since they have not been held directly responsible for the conservancy of the forests. The forest rules at present in force place the Reserved Forests in the entire management of the Forest Department, and exclude the civil authorities from it, which in some instances in Assam, where numerous unsettled hill tribes live on the adjoining land, and carry on *jhoom* cultivation in the neighbourhood of Reserves, is not a wise policy. Neither would it be advisable to place Forest Reserves under Deputy-Commissioners alone, without the professional knowledge of Forest Officers; for which reason the rules should be so altered as to provide for the management of Reserves by the Deputy Commissioner and the Deputy Conservator of Forests conjointly, where such is considered necessary.

In the Brahmaputra Valley the timber trade is also, as yet, so limited that the rules in force for regulating the transit of timber suffice for the present, and in Sylhet and Cachar this has been managed under administrative arrangements hitherto without any difficulty having been experienced by the Deputy Commissioners, so that it may be presumed that when the forest rules now in force are extended to those Districts, they will be found to suffice there also. Wood-cutters and timber-traders in this Province are as yet, comparatively speaking, simple and obedient people, looking up to the Deputy Commissioner for justice, and, as a rule, accepting his decision in forest matters without appeal, and feel perfectly safe in doing so, and forest and civil administration are becoming more combined every day in Assam."

A brief description of the methods of exploitation in force in the forests of Cachar and Sylhet has already been given in Volume II (p. 396, etc.). These districts were now under

Assam. Factors which had had some influence in destroying the accessible forests in the Khasi and Jaintia Hills were the working of lime, and also coal for local consumption in the stations of Shillong (elevation, 4951 feet) and Cherra Poonji. Iron smelting was also still being carried on in the western portion of the Khasi Hills, and the denudation of the forests on these hills was to some extent attributable to the extensive manufacture of charcoal used for this industry, a result which had occurred in other parts of India (cf. Vol. I, p. 271).

The Reports on the Cachar and Sylhet Forests sent into Anderson, the Conservator, already alluded to in Volume II, p. 396, were the only information extant on this area till the long-delayed inspection, which had been ordered, was carried out in 1874-5 with the object of submitting proposals for their management. The main rivers of this tract, fed by numerous tributaries, are the Surma, Kusiara and Barak, these being described as magnificent waterways for the transport of timber and much safer for rafts than the Brahmaputra. The forests which were considered to be best worth conserving, both in Cachar and Sylhet, were chiefly situated along the southern boundaries of these districts and were uninhabited except near their northern limits, where migratory tribes, such as the Kukies, had a few scattered villages. This absence of population was said to be due to Lushai raids. Owing to its much safer position from such raids the eastern part of Cachar, towards the Manipur boundary, had come under permanent cultivation, whilst the west of the district resembled the greater part of Sylhet, in which nearly all the suitable land had been brought under cultivation. The tracts in the north not permanently cultivated by villagers or under tea cultivation were covered with thick bamboo and other scrub growth, the aftermath of *jhuming*, and were not considered to be worth conserving as forest, the reason being advanced that "a large proportion of the population in Cachar still live by this mode of cultivation, and will have to continue doing so, it being congenial to their habits, and prohibiting it entirely would not be at all advisable for political reasons." There was still some forest left in the Naga Hills (North Cachar Hills), but the difficulties of working it were considered insurmountable, whilst the wood was said to be of inferior kinds, which would not repay a transport dependent entirely on the occurrence of high floods in the

mountain streams, and over the extraction of which no control could be exercised. A further reason was of a political nature, that interference with the people in these hills by attempting to introduce forest conservancy was at the time inadvisable. Doubtless the soundest reason of all, though not specifically mentioned, was the fact that the young Department had its hands full in more accessible and workable areas to the south, where the introduction of a proper system of management was badly needed.

The total area of forest considered worth reserving in Cachar was 825 square miles and 273 square miles in Sylhet. Within this area there were nineteen grants for tea cultivation in Cachar and one in Sylhet, nearly all of which had been surveyed in the cold weather of 1874-5 (cf. also Stewart's remark, Vol. II, p. 403). Some of the forests in the Sylhet District were claimed by the Merishdars, but the claims to ownership were considered to be very doubtful. All fellings in the forests had been stopped pending an investigation into these claims. The forests in both districts were exclusively mixed evergreen or lower-hill forest, *sâl* and *sissu* being absent. It was fully recognized that *jhuming* ruined the good forests quicker than anything else; it was therefore proposed that this form of cultivation should be confined in Cachar to the forest areas outside the proposed Reserves, the former having been already *jhumed* over a long period and containing only bamboos and valueless species of trees (*vide* Stewart, Vol. II, p. 403).

Mann comments upon the large number of species of trees occurring in the evergreen forests and on the great difficulty of ascertaining the vernacular names of trees and getting the latter scientifically identified—a trouble which many Forest Officers long after his date had to contend with. He wrote: "It is extremely difficult to give reliable native names of trees, since the great number of different tribes residing in Cachar, and want of names in the language of most of them for each particular kind of tree or wood, causes a great confusion in these names, and renders it all the more urgent that the scientific name of each kind of wood be ascertained. So, for instance, the names of 'Kurta' and 'Rata' are applied sometimes to one species only, but not the same species, in different parts of the district, whilst other people, again, frequently include three, four and more species under each of these names. Similar it is with the name 'Jam,'

which takes the place of the Assamese name 'Jamoo,' usually given to *Eugenia*, whilst here it is applied to *Schima Engelhardtia* and others" (*vide* footnote, II, p. 404).

The case is put very well here. It is a pity that so many years were to elapse before the Forest Officer came to realize that vernacular names of trees were incomprehensible outside his own Province, and often outside his district; and that in order to render reports and Working Plans intelligible to those wishing to consult them the inclusion of the scientific names of the species dealt with is essential.

It was high time that the Cachar Forests were brought under the new Department, for a very extensive timber trade was being carried on in the forests in British territory (known as the Inner Line, as compared with beyond it), the timber markets supplied being Sonaimukh and Silchar in Cachar; Banda, Churria Bazar, Sylhet, Chhatak, Sonamgunj and Azmerigunj in Sylhet; and in Bengal, Bhyrub Bazar in Mymensingh, and Dacca in the Dacca District. This timber was floated out past the Sealtek ghât toll station (*cf.* Vol. II, pp. 401, 402), situated on the Barak River near the Sylhet boundary. During the previous three years the leaseholder of the toll station stated that 48,207 logs had passed the ghât, but the Deputy Commissioner was of opinion that the number was far greater, as it was to the former's interest to conceal the correct total. One hundred and twenty elephants were said to be engaged in timber dragging, but the Deputy Commissioner thought that 200 was the probable number.

In addition to the timber exported down the river, large quantities were converted in the district itself at Sonaimukh, the station of Silchar, the Keatinge Sawmill at Budderpur and other localities. This state of affairs had been going on for a long time (*cf.* the 1832 Report on the Timber Trade of Cachar, II, p. 398) as Captain R. Stewart's Report of 1865 well shows, and it is evident that the possibility of the forests was being very heavily overcut. The method of exploitation in force was as follows: the woodcutters or their employers applied to the Deputy Commissioner for a permit to fell timber, bamboos, cane, etc., and were granted one for six months. The only proviso in the permit was that *jarul* (*Lagerströmia Flos-Reginæ*) and *negésar* (*Mesua ferrea*) should not be cut under 4 feet in girth. These permits cost Rs.5 for every party not exceeding ten men. If a larger number of wood-cutters were entered on the permit 8 annas

were paid for every additional man. The number of permits issued in this way between February, 1873, and March 31st, 1875, was 716 for 7167 men, or an average of 330 permits for 3307 men per annum.

The exploitation of the Cachar Forests had followed the same devastating course as the uncontrolled fellings in Madras, Burma and other Provinces already described in previous volumes. The difference in these forests lay in the fact that a greater number of species were utilized, but the chief brunt of the operation fell upon the two valuable trees *Lagerströmia Flos-Reginæ* and *Mesua ferrea*.

In 1863 the price of these timbers per cubic foot in Sylhet and Cachar respectively, was, for *jarul* Rs.2-8-6, and Rs.2-3-6 and for *nagésar* Rs.2-0-6 and Rs.1-13. In 1874 *jarul* was not procurable in Sylhet and was very scarce in Cachar; whilst *nagésar* fetched Rs.2-6-0 and Rs.2-4-0. At the Keatinge Sawmill inferior species fetched about 12 annas per cubic foot in 1874, the price paid the preceding year being 6 annas. Scantlings at the sawmill were sold at Rs.1-8 to Rs.3 per cubic foot, as compared with annas 13 to Rs.1-4 paid at Dibrugarh, in Upper Assam. The prices of tea-boxes, required by the tea-planters for packing their tea for transport, at the sawmill, was Rs.1-2; at Dehing, R.1.

The forest revenue on timber, bamboos and thatching-grass, the latter an item of considerable importance in this part of the country, as also in Lushai and the Chittagong tracts to the south, was collected, as has been said, at the Sealtok toll-station. The annual sum (the lease was auctioned) paid by the lessee of this station had increased from Rs.5520 in 1866-7, Rs.16,000 in 1870-1 and Rs.15,000 in 1873-4 and 1874-5 (Vol. II, p. 402). In 1871-2, when General Bouchier's Expedition took place against the Lushais the highest bid was Rs.8,000. The Deputy-Commissioner refused it and worked the station himself that and the following year, the revenue being Rs.10,000 and Rs.14,000 respectively. Generally speaking, the prices of all forest produce on which tolls were collected at the toll station had risen in 1874, as compared with those quoted on page 402 in Vol. II. The following remarks were made on this subject in the Report of 1874. If the average size of the logs in the rafts arriving at the toll station is taken at four feet girth, the average tax charged varied from annas 0-1-3 to annas 0-2-6 per cubic foot for *jarul* and from 0-0-6 to 0-3-4 per cubic foot for other woods. The timber used in Cachar District (i.e. which was not exported past the toll station) paid no tax, therefore it is only possible to compare the rates paid at the toll station with the price of timber at Sylhet, which was situated below the station. At this period the prices paid for timber at Sylhet were as follows: *jarul* not to be had; *nagésar*, Rs.2-6-0

per cubic foot; *kurtā* and *rata*, Rs.1-8-0 per cubic foot, the Government only receiving as royalty on the two latter from Rs.0-0-6 to Rs.0-3-4 per cubic foot. No tax was levied on converted timber or wood of any description, neither, more remarkable still, on any logs carried inside boats which had a thatched roof over them. Timber felled on private lands paid no toll if covered by a pass from the owner of the land. The opening thus given to smuggling timber from Government Forests is here very evident. The Report correctly summarizes this anomalous position in the following paragraph: "It is evident from the above figures that the tax paid is exceedingly small, as compared with the value of the timber, and does not represent the value of the wood in the forests, but is a mere transit duty imposed very indifferently as regards the quality of timber on which the different rates are paid."

The most extraordinary aspect of the position was the absence of any tax leviable on the timber, etc., derived from Government Forests and utilized in the Cachar District itself. It may be conceded that this state of affairs had arisen with the gradual growth of the demand for timber in the south and in the Cachar District itself, a growth directly attributable to the introduction of orderly British rule. This, as has been shown, had led as a natural sequence to the over exploitation of the accessible forests in other Provinces of the country before the advent of the Forest Officer. But in this instance the anomaly was more marked since it pressed hardly on the population of the neighbouring district of Sylhet, who had to pay for their timber and other forest produce. As the Report states, it was "neither equitable nor just to the inhabitants of Sylhet, and deprives the Government of a large amount of legitimate revenue, especially so, if an increased expenditure is incurred for the preservation of these forests, the benefit of which will accrue to the inhabitants of Cachar prior to those of any other district."

Boat building had been for long the staple industry for which the better timbers were utilized. The old practice had been to convert a single tree into a "dug-out," the heart of the tree being burnt out by fire. This wasteful practice was no longer in force owing to the scarcity of trees of suitable size and plank boats were now built. House and bridge building ranked next, and following these, tea-boxes for which *jhalna* (*Terminalia bicolorata*) was chiefly used. The following is an interesting note, with reference to present-day exploitation developments: "For furniture all the better kinds of wood,

which, however, are only found scattered through the forests in small numbers, are used, such as *cham* (*Artocarpus Chaplasha*), *poma* (*Cedrela Toona*), *gomai* (*Gmelina arborea*), *bandolat* (*Cassia Fistula*) and *champa* (*Michelia sp.*).” For the manufacture of tea, charcoal was required in large quantities which, the Report states, “renders the strict conservancy of even inferior woods imperative.” Enormous amounts of bamboos, canes and thatching grass cut in the Cachar District were utilized in the district itself free, or paid taxes at very low rates at the Sealtek toll-station.

In visualizing the existing state of affairs in these districts (and elsewhere in India) and throwing a glance back through the years of the preceding half-century, the reflection is unavoidable that had the British race and their rulers possessed even the most elementary ideas on the value of forests and their true position in the economy of nature and of a country, and these matters, as we know, were well understood at the time almost at our doors across the Channel, the periodical financial crises of the Honourable East India Company need never have occurred. The wasteful and unchecked exploitation of the great Forest Estate which had fallen under their rule must have resulted in the loss of millions of pounds sterling which might have been realized in revenue. The warning and its results are there and require careful study; for nothing is easier than to upset a well-ordered and established administration of a Forest Estate. A few years of unchecked or only partially checked over-exploitation will take a century or more of work to repair, a serious calamity for a population to whom forest produce, either in its daily life or for its industries, may be a necessity.

The position of the rubber question was in much the same state in Cachar as in Assam. The Report states: “The trees of *Ficus elastica* are in the same exhausted condition as those in Assam Proper, perhaps more so, since the Lushais make it their business to come in the cold weather from their own country, where there is less rubber now, in search of it to the Cachar Forests. Rubber has always been exported largely from Cachar and the adjoining countries since 1862, and its conservancy has been urged since 1869; but the difficulties of controlling the tapping have, as in Assam, proved insurmountable.”

The quantity of foreign rubber brought into Cachar between 1870-5 was as follows: from the Lushai country 15,746

maunds to 1499 maunds. Owing to the Lushai Expedition no rubber was brought in during the season 1871-2. The facilities for smuggling rubber were said to be greater in Cachar than in Assam, "besides which," says the Report, "the people generally seem more awake to the large profits to be made in this trade. The quantity of smuggled rubber seized from 1868 to March, 1875, was 153 maunds." The writer continues: "The trees, as existing at present, would require many years' protection before they could recover, if this is at all possible, and it could only be ensured by more frequent inspection of the forests than they have hitherto received. The effectual protection of rubber trees is, however, considered impracticable, and improved arrangements of watching over them here, as well as in Assam, will, it is considered, only defer their total destruction. This is so far an advantage, as it will give the trees planted by the Forest Department time to grow up and thus ensure, to some extent, the keeping up of the supply of rubber from the Province." Doubtless the treatment of the rubber trees in the past made this attitude on the part of the Forest Department almost inevitable, since supervision by its small staff was out of the question, but at the time the Commissioner had not given up hopes of being able to save the remaining wild rubber trees by means of creating a Government monopoly.

The Report then deals with *jhum* cultivation; the people practising it here being Kukies, Nagas and Cacharis. Of these the Kukies were said to be the worst, since they always *jhumed* in high forest, the destruction of valuable forest under their activities being generally admitted to be very great. The Nagas more often returned to old *jhums* or started permanent cultivation; whilst the Cacharies, it was stated, "are said to be taking to permanent cultivation also now, as it is less laborious and more productive."

Mann remarks that there was no danger from fire in these forests "since they cannot burn." He points out that Forest Conservancy can hardly be said to exist since there was no control over the fellings, and that it was a pity that the restriction prohibiting the felling of *jarul* and *nagésar* under 4 feet in girth had not been made applicable to all species. The districts dependent upon these forests for their supplies to a great extent were Cachar, Sylhet, Mymensingh and Dacca, and the ruin of the Cachar Forests was likely to cause considerable hardship in these densely populated districts in the future.

The Deputy Conservator submitted proposals for revising the rates of toll levied in Cachar and also on the rates to be charged on timber imported from Manipur, which were being considered by the Commissioner. Mann's treatment of the position of the Cachar and Sylhet Forests at this period is an admirable and lucid statement, and gives an invaluable insight into the existing position and the causes which reduced them to their condition at the time.

The Report then deals with the formation of Reserves in Assam Proper and alludes to the successful protection from fire of the Gauhati sâl forests, the assistance given by the Deputy Commissioner and his mouzadars in this connection being acknowledged. Considering the infancy of the Department in the Province and the difficulties being experienced elsewhere in India in introducing fire conservancy this must be regarded as a remarkable achievement; even when the acknowledgment was made, as it was made, that the inauguration of conservancy in Assam was an easier problem than in some of the other Provinces of the country. Mann suggested that a tax of 2 annas per maund should be levied on charcoal in order to prevent waste and to enable Government to ascertain the consumption of timber for this purpose. The Commissioner agreed to a tax being levied, but thought 2 annas was too high.

On the subject of the Goalpara sâl forests, the Deputy Conservator stated that all mature trees had been felled and removed before conservancy measures were introduced. "This," said the Chief Commissioner, "appears to be the rule throughout India. Conservancy measures are only adopted in a forest when its crop has been cleared, and when, therefore, no present revenue can be expected." He expressed the hope that this mistake would be avoided in future in this Province. The Chief Commissioner also pointed out the great saving which would accrue by using teams of buffaloes for timber hauling instead of elephants. Three of the Forest Department elephants had died of an "epizootic" disease during the year and twenty privately owned elephants had died in a similar fashion. Finally, Colonel Keatinge (the Chief Commissioner) said that Mann had not made concrete proposals as regards the management of the large areas of forest which were to be left under the charge of the Deputy Commissioners. On this important subject the Chief Commissioner rightly added: "It is quite impossible that special departmental officers should be provided

to take charge of even a small portion of the large forest areas in this Province. The problem to be worked out is how to protect and manage forests with the ordinary administrative agency at present available. There are conditions which make the problem less difficult in this primitive Province than it is in other Provinces. The Deputy Conservator is entertained for the sake of forest management generally, and not only for the sake of the small Reserves which are under special Forest Officers."

This remark indicates how well the Forest Conservancy problem was being envisaged from its inauguration in Assam. The Chief Commissioner's remarks apply at the present day with equal force to many of the new Forestry Departments in Africa and elsewhere under the administration of the Colonial Office. Progress in Forest Conservancy in these countries will depend—must depend—on the manner in which a general forest policy for the country concerned is introduced, not only for the conservancy of a comparatively "small area of Reserves," but for those other forest areas which cannot be, or are not, at the time for various reasons, created Reserves.

The plantations dealt with in the Report are the Kulsi Teak Plantation, the Charduar Rubber Plantation and the Shillong Plantation. There was also a small experimental area of teak on a hill at Makum (where the older plantations had failed) and some small experiments in *Cinchona* cultivation, started in the hills near Nongklao and Jirang by the Superintendent of the Botanical Gardens, Calcutta, in 1867, which had been placed under the Forest Department. The sites for these plantations had been selected in order to keep the work concentrated and near the headquarters of the officers in charge of the Forest Divisions; the Shillong Plantation was under the Superintendent of the Shillong Farm. At the end of 1874-5 there were 53 acres of teak and 20 acres of *sissu* plantations at Kulsi. The growth of the trees in the 1872-3 plantation (Burma seed) was excellent, the ground being completely covered and average measurements being 12·7 feet in height, 6·6 inches in girth at 1 foot from the ground. That from the Assam seed was not so good, the seed having failed at first. Mann remarked on the tendency of the trees to branch at an early age, which, he said, was a disadvantage and could only be counteracted by early and judicious pruning. In alluding to this, Colonel Keatinge (in his Resolution, 27th October, 1875, on the Report) said he felt much diffidence in

criticizing Mr. Mann's views on a professional point, but "he must express his doubt of the good effect of the pruning which Mr. Mann advocates. He cannot but think that it would be better to permit the growth to proceed until the branches meet, and to trust to the upward growth taking place after that period. When the trees are sufficiently close to one another, the growth upward must come soon in the struggle for light." Keatinge appears to have possessed some knowledge of forestry. It is interesting to compare his remarks with those of Lord Tweeddale made in 1846 on the Nilambur Teak Plantations in Madras (cf. Vol. I, p. 97). The "Kulsi teak borer," as it came to be called, had become recognized as a source of danger, its grub travelling up the stem and killing the young trees. Aylmer had not yet discovered the mature beetle, however, in spite of careful research. The *sissu* plantations were doing well and a large nursery had been prepared for *tun* (*Cedrela Toona*) which was to be planted in mixture with the teak. It was also intended to plant *nahor* (*Mesua ferrea*) instead of *sam* with teak in future. There were also 35 acres of rubber plantations at Kulsi, whilst another 30 acres of ground had been prepared during the year. The total sum expended on this area worked out Rs.15.2.1 per acre, including formation of nursery and purchase of suitable cuttings, which were difficult to get.

The Charduar Rubber Plantations were started in 1874 by the preparation of a large nursery in which cuttings were laid down and seed also sown in April, 1874. Artificial shade had been left over the nursery as a precaution. A year's experience showed this to be a mistake as the heavy drip caused the death of large numbers of cuttings and seedlings. The seed germinated best on broken brick, next on broken charcoal and least on the earth. Eventually broken charcoal proved the best germinating bed. Four hundred seedlings had been brought in by Miris from the Akha Hills to the north and were planted in the nursery. No seedlings were present in the dense evergreen forests at the foot of the hills, where sufficient light was absent, but it was recognized that the seed would readily germinate on steep hill-sides where more light was available; they also germinated readily on the well-cultivated land in tea gardens. The best time for making the cuttings was between the middle of January to end of May. In 1875 there were 16,401 cuttings alive out of 21,213 put down. In 1873-4 the plantations of rubber extended to 180 acres. During 1874-5 another 140

acres were got ready, whilst a further 60 acres were being cleared. The method of planting adopted was to clear lines at 20 feet apart. The width of the lines proved insufficient as soon as the monsoon set in, owing to the excessive shade and drip, and plants died. The lines were therefore opened to 40 feet width, and the effect on the young plants was said to be remarkable. The only drawback to the increased width was the increased cost of the operations and the difficulty of getting labour, which, owing to the wages offered by the tea gardens, was a growing one. The experiment was therefore started of planting young seedling plants in strongly made baskets and placing them in the forks of trees. This method of planting would only necessitate a small bridle-path being opened out through the forest. Mann did not advocate the system if labour was procurable as inspection and protection would be very much more difficult. An expenditure of Rs.2-4-0 per acre had been incurred for planting the 180 acres, but a subsequent charge was incurred for opening the lines to double their width. The total cost of the plantation to end of 1874-5, including all charges and salaries, came to Rs.13-1 per acre. It was estimated that this charge should come down to Rs.10 per acre. Mann had suggested the reservation of an area of 140 square miles in the Charduar north of Tezpur for rubber plantations; this matter had not yet been decided.

As regards Shillong, the summer hill station of Assam in the Khasi Hills, an area of 580 acres was leased in the year 1871-2 at the rent of Rs.50 per annum for the purpose of forming timber plantations in the vicinity of the station, the Government having the warning of the timber and fuel difficulties of Simla, Ootacamund and other stations in the hills before then. In the year 1873-4 an orchard of about 5 acres was bought by the Forest Department. The timber plantation land was demarcated and remained in charge of the Deputy Commissioner. About 50 acres of this land was covered with *Pinus Khasya*, which it was intended to preserve. All the rest was to be planted and sown, partly with *P. Khasya* and partly with evergreens and exotic broad-leaved trees. A nursery of 1 acre was prepared during 1874-5 and the seeds of a variety of species, received from the Conservator of Bengal and collected by the Department in the hills, were sown. A considerable number of seedlings of oaks, chestnut, walnut, several species of *Eucalyptus*, *Casuarina*, various European

pinus, W. Himalayan conifers, *Wellingtonia* and *Cryptomeria* were raised and some planted out. It was too soon to express an opinion as to the results. The Cinchona Plantations, thirteen in number, were inspected by Mann (who it will be remembered started his connection with India in the Sikkim Cinchona Gardens) and reported as doing well.

In that fascinating volume (in spite of its austere official title) the "Report on the Administration of the Province of Assam" for the years 1874-5 and 1875-6, the first to be compiled for the Province since it was constituted a separate Chief Commissionership, under the Section on "Forests," some interesting remarks by the Chief Commissioner are to be found: The forests of the Garo Hills, which were subject to extensive *jhuming* by the Garos, were inspected in 1876 and were found to contain but a small proportion of sâl and valuable timber trees. As it was not considered advisable to interfere with the *jhuming* at the time, no reserves were to be formed, and the forests were left under the management of the Deputy Commissioner. Of the total area of Reserves constituted in 1875-6, 348 square miles were added in the Eastern Duars of the Goalpara District. It had been formerly gazetted as "open forest." A large proportion of it was sâl forest which had been depleted to furnish the great timber markets of Bengal. In the Sidli Duar very valuable forests were also surveyed during the year, but as there were many villages and cultivated lands scattered through them they had remained "open forests." The question of declaring them Reserves was under consideration. The Garumari Sâl Forest in the Darrang District, the eastern limit of the sâl tree, 205 acres in extent, was declared a Reserve, as also the Bhamaraguri Hill Forest in the same district, 387 acres. This forest had been purchased some years ago with a view to supplying fuel for the Government steamers. During the same year the Charduar Rubber Plantation Reserve was sanctioned. Of this Reserve $34\frac{1}{2}$ square miles were placed under the Forest Department, and the remainder, $45\frac{1}{2}$ square miles, was under the management of the Deputy Commissioner, subject to inspection by the Forest Officers. No steps had as yet been taken towards forming Reserves in the Cachar and Sylhet Forests.

The important work connected with the determination of the actual growing stock present in the forests had been commenced during the year, valuation surveys having been made in the Kholahat, Deboka, Balipara and Sidli Forests.

Fire protection, considered so important for the sâl forests, had not been so successful during 1875-6 owing to the exceptional drought and very high winds. Early in 1874-5 measures had been taken to put a stop to the indiscriminate burning of the forests in the Khasi and Jaintia Hills and the "Seims," and Village Officers were made responsible for the conservancy of the sacred groves. These measures had met with some success, but, as Colonel Keatinge says, "it is a very difficult thing to change the habits of a population, or to induce them to incur even a very small temporary inconvenience for a future benefit." The realization of the true objects of Forest Conservancy could only come slowly through the education of the people. This has been as true in Europe as in India. That they can be assimilated both Europe and India bear witness.

The plantation work was progressing favourably save at Shillong, where the only exotics which showed promise were *Juglans regia*, *Eucalyptus rostrata* and *Pinus maritima*. The bark of the cinchona trees from the Assam Plantations had been submitted to the Government Quinologist at Darjiling, who had reported unfavourably on it. The plantations were made over to the Seim of Nongklao during the year.

With reference to the large tracts of forests which remained under the charge of the Deputy Commissioners, whose boundaries were undefined, the Chief Commissioner says that, although not gazetted as open forests under the Forest Act VII of 1865 (which was in operation in Assam), they were in every way watched over as strictly as if they had been so gazetted. Rules had been made by the Chief Commissioner for these areas which were designed in great measure to check *jhuming* operations, and the mouzadars were the persons immediately responsible for the conservancy of the forests, and failure in this respect would be met by dismissal. The Chief Commissioner had also particularly impressed upon the Deputy Commissioners the importance which he attached to the management of this portion of their charges. Rules had been drawn up for the felling of tax-paying timber, and the general principles on which applications for timber-bearing lands were to be treated had been laid down by the Chief Commissioner. The proposals for the revision of taxes were still under consideration. The quantity of timber removed from the forests during the two years 1874-6 was—by departmental agency, 2753 logs and pieces, approximately 41,239 cubic feet, and by pur-

chasers, 40,869 logs and pieces, cubic contents unknown. The total receipts for the years 1874-5 and 1875-6 were Rs.64,749 and Rs.61,872 respectively, the expenses for the two years being Rs.59,523 and Rs.61,884.

"The Forest Department," said the Chief Commissioner, "is still in its infancy ; but in reviewing its operations for the last two years he was able to say that much has been accomplished. The forest establishments at his command were too small for the management of extensive tracts. But the Reserves under the direct control of the Forest Officers were schools where much could be taught and learned. He aimed at something more than the conservancy of a few Forest Reserves. He aimed at the protection from fire and *jhuming* of some 15,000 square miles of forest—forest that, from its geographical position, should, in days to come, supply the timber of nearly all Eastern Bengal and yield a large amount of revenue to the Province."

These were expressions of opinion of a far-sighted man, and, in all his actions, Colonel Keatinge showed not only that he was thoroughly alive to the value of Forest Conservancy in his Province, but also that he understood the aims and objects of such conservancy ; whilst he realized, as a Frontier Political Officer with savage tribes to deal with, some of whose chief methods of amusement and excitement were head-hunting and raiding amongst their neighbours, that its introduction must be undertaken with skill and caution.

His proposals for settling the rubber question by a draft Regulation declaring the right of Government to all rubber, home-grown or imported, and imposing a penalty on the collection or purchase of rubber without a licence, or sale by the latter save to the persons mentioned in the licence, thus creating a strict Government monopoly, were not accepted by the Government of India, who declined to impose any special restrictions on the rubber trade. A considerable revenue was thus lost to the Government for a certain number of years. But, in any event, the wild rubber trees of Assam had suffered too heavily and were doomed to disappear. The neglect had lasted too long. But it is curious that the Government of India should not have accepted the proposal of the Officer on the spot, and especially when, in their Chief Commissioner, they had a man thoroughly acquainted both with the forests, the rubber question and the people over whom he ruled.

During the next decade forest organization proceeded but

slowly in the Province. In 1884-5 the area of forests under the Department and District Officers was 9595 square miles, of which 2342 square miles were Reserves, 863 square miles Protected and 6390 square miles District Forests. Forest Officers were few, and the local rules for the District Forests were working well. Fire protection, which had been troublesome, showed a marked improvement, the percentage of failures having fallen from 29 to 5 per cent. The cost, however, Rs.25 per square mile, was still very high and would remain so until, as the Inspector-General remarked, "larger areas are fire protected and until the vast areas of savannah land outside the Reserves have been brought under cultivation or become otherwise less liable to burn." In 1885-6 the Inspector-General ("Rev. of For. Administr.") wrote: "The area of Reserves amounts as yet to only 5 per cent of the country. Under present circumstances this might be sufficient, but the time is rapidly approaching when the Province will be opened out by railways and will be much more extensively cultivated than it is now. It is accordingly essential that the area of Reserves should be largely increased in order to meet future requirements." Two years later considerable additions had been made to the Reserves, and the Inspector-General, remarking upon the fact, said: "The permanently sanctioned Protective Establishment in the Assam Forest Department is small and has to be strengthened annually by a large temporary establishment"—always an unsatisfactory expedient and a deterrent to real progress. In 1893-4 Hill, Acting Inspector-General, again remarked upon the slowness with which reservation was proceeding. In spite of, or perhaps by reason of, the large area of forests in Assam, the people were slow in realizing the reason for fire protection. In alluding to the bad year experienced in 1891-2, Ribbentrop ascribes the success of natural reproduction in the Province almost entirely to efficient fire protection, and remarks: "An interesting feature is the encroachment of the sâl on the open grass plains adjoining forests of this species in the Garo Hills and in Goalpara. In the latter district, also, the sâl is gradually displacing the dry deciduous forest."

The total area of the Charduar Rubber Plantation had increased to 1168 acres by 1885, but the sum received from the Rubber Mehals showed a decrease of Rs.20,660 as compared with Rs.36,700 the previous year. In 1888-9 the following appeared in the Inspector-General's "Review of Forest

Administration" under 'Sowing and Planting': "The greatest amount of success was obtained in the rubber plantation (Charduar) which was extended by 74 acres, and experimental sowings of some of the more valuable Assam timber trees were continued with the view of eventually improving the composition of the forests. The efforts made to induce the people to grow these trees with their crops in *jhumed* areas were not on the whole successful. These efforts will, however, it is hoped, be persevered in, as, owing to the scarcity of labour in Assam, there are at present no other means by which the vast areas of unreserved forest in the Province can be improved on a large scale, or the injury done by *jhuming* be counterbalanced." Before the close of the century it was reported that some progress had been made in persuading the *jhumers* to rear tree crops on their *jhums*. But the method made but slow progress in Assam.

The Charduar Rubber Plantation experienced some vicissitudes in policy. At one time the extension was stopped. By 1891-2 the total expenditure on the plantation from formation amounted to about Rs.1,22,000, and the Government of India expressed the opinion that latterly some avoidable wasteful expenditure had been incurred. With the decrease of the natural rubber in the forests the Charduar extensions were proceeded with.

In a backward Province like Assam, where forestry was a new institution, it was not probable that the revenue would increase very rapidly. The receipts for 1883-4 and 1884-5 were, respectively, Rs.2,11,445 and Rs.1,80,403, and the expenses, Rs.1,99,562 and Rs.1,97,669, showing a deficit for the latter year. Matters gradually improved, however, and in 1889-90 the receipts were Rs.3,79,498 and the expenditure Rs.2,57,129. On this satisfactory result the Inspector-General remarked: "The gross revenue and the surplus were the highest yet realized in Assam; the surplus for the previous year, which until then was the highest recorded, being only Rs.93,977 (as against Rs.1,22,269 in 1889-90), while the *average* surplus for the ten years 1879-80 to 1888-9 amounted to Rs.25,000. This satisfactory improvement in the financial working in recent years can, in great measure, be attributed to the development of the local and export trade in timber, but, in so far as it is the result of effective administration, is also creditable to the forest staff." The receipts had dropped to Rs.3,36,129 in 1891-2, and had been lower still the preceding

year. A duty had, however, been recently introduced on cutch, a product of *Acacia Catechu*. In the following year the sum realized from this source amounted to Rs.49,600 and the annual revenue was Rs.3,82,830. During the last decade of the century the revenue rose, and in 1899-1900 it amounted to Rs.5,68,100 (the average for the preceding five years having been Rs.4,15,912). The surplus for this year was Rs.2,10,960, the average for the previous quinquennium having been Rs.1,29,042.

It will be remembered that it was in 1891 that a special Forest Regulation was passed for Assam to replace the Indian Forest Act, which had been found unsuitable (II, p. 474).

Owing to the late inauguration of a Department to administer the Assam Forests, it was to be expected that in the early years progress in Working Plans would be slow. But the record under this head for the period under review is lamentable. There were no sanctioned Working Plans in force in 1888-9. In the following year the survey of the important sâl forests of the Goalpara District was commenced by the Forest Survey Branch. In Goalpara the preliminary work of triangulation and traversing was carried out, the former over 94 square miles, and the latter over 439 square miles. This work was resumed the following year. An area of 180 square miles was topographically surveyed and a record of the distribution of the forests and the quality of the soil was prepared. Triangulation and traverse work were also continued. Meanwhile, in 1889-90, the special Working Plans Staff was employed in Goalpara in connection with the survey of the sâl-bearing tract and in classifying the forest growth in accordance with the recommendations contained in the Inspection Report of the Inspector-General and in the enumeration of sample plots. In the following year the Working Plan Party continued the work of classification of the growing stock and in opening compartment lines, 422 square miles being examined. But this type of work was not understood by the staff of the time, as the following extract from the Inspector-General's Annual Review for 1891-2 clearly shows: "Work was restricted, as in previous years, to the Goalpara Sâl Forests. The collection of material for the preparation of this plan was commenced in 1888-9 and has since proceeded almost uninterruptedly, at an expenditure, exclusive of the cost of the Forest Survey, but including the pay of the officers employed thereon, probably already in excess of Rs.50,000. A preliminary Report on the lines which

it is proposed the Working Plan shall take was submitted in April, 1893. The Government of India, when reviewing the Conservator's Report for the year, drew attention to the high expenditure incurred on this plan and to the fact that the high cost of the plans prepared in previous years had been decidedly out of proportion to the results achieved. There are good grounds for this assertion, since the few Working Plans already sanctioned in the Province have been costly failures. Money and time have been wasted in unnecessary elaboration, particularly on the detailed enumeration surveys, which have been made with a view of securing that the forests should not be overworked. But . . . overworking was not likely, under any circumstances, to take place in the localities considered ; and, in fact, some of the forests for which costly plans have been drawn up, have proved unworkable, for the present at least." The Goalpara Plan was completed in 1893-4 and sanctioned in the following year. Deviations from its provisions had already taken place. It was at this time the only plan in the Province.

In 1896-7, of the total area of 3682 square miles of Reserves 533 square miles only were under Working Plans. Of this area 522 square miles were in Goalpara, where hitherto it had not been found possible to work out the number of trees prescribed under the plan. The only new work of the year was the preparation of a scheme, auxiliary to the Goalpara Plan, to regulate the removal of trees other than *sâl*. This scheme subsequently received sanction. In 1899-1900 the total area of forest under the Department was 20,061 square miles, comprising 3609 square miles of Reserves and 16,452 square miles of Unclassed Forest, or 44.2 per cent of the total area of the Province. Of this area 533 square miles of Reserves were under Working Plans at the close of the century. Of the remaining 19,528 square miles the 16,452 square miles of Unclassed Forest did not require Working Plans.

PART II

THE GENERAL PROGRESS OF FOREST CONSERVANCY AND THE INAUGURATION OF FOREST RESEARCH WORK IN INDIA AND BURMA, 1901-25. THE EFFECTS OF THE GREAT WAR AND OF THE CONSTITUTIONAL REFORMS ON FOREST POLICY

CHAPTER XI

A BRIEF HISTORICAL REVIEW OF ADMINISTRATION IN ONE OF THE MOST IMPORTANT PERIODS IN THE HISTORY OF INDIA, 1901-25

THE period dealt with in this chapter is covered by the Vice-Royalties of Lord Curzon, Lord Minto, Lord Hardinge of Penshurst, Lord Chelmsford and Lord Reading. Lord Curzon had succeeded Lord Elgin as Viceroy and Governor-General early in 1899 and was the youngest of the Governors-General with the exception of Lord Dalhousie. Lord Curzon had travelled widely in the East, being an acknowledged expert on Eastern affairs, and had also been Under Secretary at both the India and Foreign Offices. Next to Lord Dufferin, therefore, he took up the office with a much greater experience than many of his predecessors. During his tenure Lord Curzon carried out innumerable administrative reforms which had the effect of sweeping away a great many ancient shibboleths which had served as clogs on the administration for far too long. And in every case the changes were made after the Viceroy had satisfied himself by a personal study of the administrative methods of the particular measure or department concerned that improvements were both needed and possible. The great energy and the powerful brain which he brought to the task are well known to all who served in India during his administration. A consideration as to whether Lord Curzon went too fast in his changes lies without the province of the present work. That Departments were in some cases moving too slow is certain and the Forest Department in one respect—that of research—is a case in point. To Lord Curzon's wide administrative outlook and to that of the Inspector-General of Forests of the time, Sir S. Eardley Wilmot, the Department owes its start in this important direction, a start which has, in some degree, almost revolutionized its whole outlook.

In chronological sequence the first of the events occurring within the period having a bearing on forestry administration was the great famine of 1899-1900, a disaster all the more formidable since it followed so soon after that of 1896-7, the latter believed to be the worst ever experienced in India. Lord Curzon and his officers in the afflicted Provinces exhibited great energy in relieving the distress, but it was considered open to doubt whether too great a lavishness in expenditure had not been shown in the Central Provinces. A Famine Commission, under the presidency of Sir Antony (later Lord) MacDonnell was set up and issued its Report in 1901. A curious oversight in this Report was that it contained no reference to the great assistance the forests of the country were capable of affording to the people and their flocks on such occasions; and this, in spite of the fact that the value of the forests was far better understood in 1901 than in 1880, when an allusion to the forests in the Report of Lord Lytton's first Famine Commission was made (II, p. 459).

A notable event of the period was the Tibet Mission or Expedition, 1903-4, under Sir Francis Younghusband, the great explorer, who at the age of twenty-four, whilst yet a subaltern of the King's Dragoon Guards, was the first white man to cross the Mustagh Pass in his great journey from Peking to Kashmir and India in 1887. The Mission eventually went to Lhasa, thus temporarily occupying this previously impenetrable capital for the first time. Whether the political objects gained were not thrown away by subsequent orders from the Home Government need not be entered into here. But it seems not impossible that benefit may ultimately be carried to the great forest tracts at the lower levels which are now better known as a consequence of the expedition. The more recent Everest Expeditions have also proved useful in this respect.

A more important step in its effects on Forest Administration was the formation of the North-Western Frontier Province. The main object was to facilitate the management of the tribal frontier until then under the Punjab Government. Lord Curzon adopted with modifications Lord Lytton's idea and created in 1901 the North-Western Frontier Province under a Chief Commissioner with headquarters at Peshawar. All the territories to the west of the Indus, with the exception of the Dera Ghazi Khan District, and also the Hazara District, were included in the new Province. To prevent confusion the old North-West Provinces were renamed the Agra Province and

the whole of this Province was called the United Provinces of Agra and Oudh, or U.P. for short.

Another transaction which to some extent had some influence on forest management in the locality was the settlement of the longstanding Berar difficulty. Berar had been for years a separate Province attached to the Central Provinces, managed by British Officers on behalf of the Nizam of Hyderabad. Lord Curzon had a confidential personal discussion with the Nizam on this question and, as a result, Berar was made over to the British on a perpetual lease on certain financial and other terms which had for their object the preservation of the nominal sovereignty of the Nizam. Berar was then made a division of the Central Provinces. The Hyderabad Military Contingent thus came to an end.

In reply to criticisms on the land revenue, Lord Curzon replied in an exhaustive Resolution written by himself in January, 1902, pointing out that famines were due to drought, not to over-assessment, and he laid down principles designed to ensure greater elasticity both in assessment and in collection. With the object of making an endeavour to reduce the indebtedness of the ryots to the trading and moneylending classes, which constantly led to the transfers of ownership or tenant-right to these classes, a Land Alienation Act (XIII of 1900), was passed, applicable to the Punjab, where the situation was particularly bad in this respect. The main clause of the Act stated : " that moneylenders, shopkeepers and professional men cannot buy land from hereditary cultivators or hold such land on mortgage for more than 20 years without the consent of the State." The sale of land to the excluded classes under decree of Court was also forbidden. The principle of the Act was extended to certain other territories, but the difficulties of working it were considerable. Probably a more hopeful departure was the establishment of co-operative rural banks, modelled on the German system.

Lord Curzon also gave earnest study to the educational problem. These labours aided by a Committee and then by a Commission resulted in the enactment of the Universities Act, 1904. This Act reduced the excessive numbers of Members of the Senatus, reformed the constitution of the Syndicates or executive bodies, placed in the hands of the Government of India the final decision concerning the affiliation or dis-affiliation of colleges and provided for the official inspection of affiliated colleges. That reforms were needed, especially in

Bengal, was undeniable. Lord Curzon's object had been to raise the level of higher education. But unwittingly he roused a storm in educational and other centres who quite incorrectly maintained that he was doing the reverse. The reforms were long overdue, but they did not produce the effect anticipated, and the question, as will be shown, was reopened later, and as far as the Forestry Department and, in fact, the Services generally are concerned this became a question of importance.

There was another measure which gave rise to an outbreak of feeling, and worse—to serious unrest. This was the so-called partition of Bengal. This partition originated from the desire which amounted to a necessity to do something towards lightening the burden of the Lieutenant-Governor of Bengal who was administering a territory of 189,000 square miles with a population of 78 millions. The part of the over-swollen Province which perhaps suffered most from neglect, both financially and otherwise, was Eastern Bengal. Certainly during the three years the writer was stationed at Chittagong we saw the Lieutenant-Governor once for a bare two days when he visited the port in a R.I. Marine Ship. Under the partition the Divisions of Dacca, Chittagong and Rajshahi were separated from Bengal and attached to Assam which was raised to a Lieutenant-Governorship with the designation of the "Eastern Bengal and Assam Province," the capital being at Dacca. This arrangement gave rise to great hostility both in Calcutta and throughout Bengal, where it was said that the Bengali nation was being rent asunder; and unrest and crimes were the outcome. The excitement was, however, considered to have died down by 1910, and Eastern Bengal had begun to feel the benefits of having a Government on the spot.

From the scientific point of view the two achievements of Lord Curzon in India which will be remembered were the formation of the Agricultural Institute at Pusa and the appointment of a Director-General of Agriculture, and for the Forestry Department the equally important creation of the Imperial Research Institute at Dehra Dun. The latter was in one sense a sequel to the first. The Forestry Research Institute will be considered in greater detail later.

Lord Curzon went home for six months in 1904 on the understanding that he should return to India for a further term of office, Lord Amthill officiating as Viceroy during the period. On Lord Curzon's return to India a controversy arose between

him and Lord Kitchener, the Commander-in-Chief, on Army organization. Lord Kitchener's views were upheld by the Secretary of State and Lord Curzon resigned in 1905 and was succeeded by Lord Minto, great-grandson of the Governor-General of India, who had conquered Java and Mauritius almost a century earlier. The Minto regime was a period of quietude for the officials responsible for Government administration. A lull followed the departure of Lord Curzon. A noteworthy feature of this period was the termination of the long diplomatic discussion between the British and Chinese Governments on the subject of the opium traffic. The export in opium brought in a large revenue to the Indian Treasury. In 1907 the traffic was stopped with a consequent voluntary heavy loss to Indian revenues. In other ways Lord Minto's Viceroyalty was a troublous one. Constitutional changes under the ægis of Lord Morley, the Secretary of State, were under consideration and a bad outbreak of anarchist crime, a new feature in India, made its appearance.

The event which was to lead up to great changes in the administration of India was the passing of the Indian Council's Act of 1909. It was decided by Lord Morley and Lord Minto, in accordance with promises which had been made, that when the time was ripe Indians should be added to the Governing Councils, that the next step forward should be taken to this end. It will be remembered that Lord Ripon's administration passed a series of Acts, 1883-5, introducing a scheme of local self-government, based on the inauguration of District Boards (Vol. II, p. 451). After three years of discussion between the Secretary of State and the Governor-General in Council it was decided to introduce the following measures. The members of the Madras and Bombay Executive Councils were to be increased and similar Councils would be instituted in other Provinces. The Legislative Councils were considerably enlarged and were granted power to pass resolutions on the budget or any other matters of general public interest. The principle of election to the Councils was specifically recognized, though to a certain extent the power of nomination was retained. The regulations issued under the Act created non-official majorities in all the provincial Legislative Councils while maintaining an official majority in that of the Governor-General. Briefly, these were the Constitutional changes effected by the Indian Councils Act of Parliament of 1909. As a result an Indian was appointed to the Supreme Executive

Council. Lord Morley had already appointed two Indians as Members of the Council of the Secretary of State.

The anarchist conspiracy and the crimes which it led to, incited by certain sections of the newspapers, resulted in the Indian Government being forced to introduce certain Press restrictions, as had been done by Lord Lytton in 1878; and other emergency measures were enacted. It is curious to reflect that Lord Lytton's Press restrictions were necessitated by the Russian victory over the Turks in 1877 and the Treaty of Stefan in March, 1878. England was strongly opposed to Russia obtaining possession of Constantinople. The successes of Russia were welcomed by a section of the vernacular Press in India, who published seditious articles against the British and in favour of Russia. In 1909 the reasons for the unrest and crime, although to some extent due to the Universities Act and the partition of Bengal, had sprung in all probability from the defeat of the Russians by the Japanese, an Asiatic race.

In 1910 Lord Minto completed his term of office and Lord Hardinge of Penshurst was appointed Viceroy.

Since the time of the Great Akbar probably no decade in the history of India as a whole has been so pregnant with changes and fraught with future possibilities as the one which followed Lord Minto's departure. In common with other Departments, including the Indian Civil Service, the Forest Department, now firmly seated in the saddle and seemingly with its most formidable fences behind it, was suddenly to find itself, temporarily at least, in a strange country with unknown and therefore incalculable obstacles in front of it.

The period witnessed the visit of their Majesties the King Emperor and the Queen to India, the Great War and the introduction of Constitutional Reforms which were to vitally affect the administration of India throughout all the important Departments of State.

Lord Hardinge is a grandson of the Governor-General who conducted the first Sikh War. The first measure of importance which took place during his administration was the Census of 1911. This showed that the population of the Indian Empire was over 315 millions, an increase of 7·1 per cent since 1901. The figures were: total population, 315,156,396; for the three cities of Calcutta (with suburbs), Bombay and Delhi, 1,222,313, 979,445 and 232,837 respectively.

Their Majesties arrived in India in December, 1911, and held a Coronation Durbar in Delhi on December 12th. At this

magnificent gathering His Majesty the King-Emperor made two important declarations. The first was the modification of the partition of Bengal, a step which had been deemed advisable. Under the modification Assam once again became a Chief Commissionership, Eastern Bengal being restored to Bengal under the Calcutta Government; whilst a new Province was created, named Bihar and Orissa, which included those areas and also Chota Nagpur and Sambalpur from the Central Provinces, the capital being at Patna-Bankipore. From the Forestry point of view the formation of this Province was to the good since it ensured a closer management of areas which had been previously, owing to the urgency of more important work elsewhere and the inadequate staffs, much neglected. The second announcement made by His Majesty was the transference of the Capital of India from Calcutta to Delhi, the seat of the Old Moghul Empire.

The outbreak of the Great War in 1914 proved, in manifold ways, the loyalty of India as a whole to the British Raj. The spirit and energy of the Indian Princes was magnificent and the enthusiasm of the Indian Army, or the New Armies, for extensive recruiting for its ranks was necessary, was obvious to all who came across them in France or elsewhere on the wide-flung battle-fronts. It demonstrated, however, in no uncertain manner, what had been suspected by some, that an economic revolution had taken place in India. Two short decades before 1914 India was but little changed economically from the India of a century earlier. Railways had come and transport was quicker, but this had scarcely affected the agricultural masses. Indian industry had scarcely moved out of the old lines and Indian capital was still waiting for individual investment. But by the time of the outbreak of the Great War Indian industry had begun to awaken. The great Tata scheme was that of an able and far-seeing man. Tata planned iron and steel works in order to commence a cycle of Indian manufactures, and he planned on a large scale, works which proved invaluable during the war, although the slump in trade subsequently affected them to some extent. With the coming of the great industries it was discovered that India did not, as yet, possess a large labour force for industrial purposes; indeed it was difficult to keep the new factories going owing to want of labour. To a certain extent this was due to the population being an agricultural one and to the necessity of first training the

agriculturist to industrial labour. But the fact remains and may yet have its repercussion on Forest work. But the increase in railways and transport facilities, the disappearance in many parts of the country of the "village immobility" as it has been termed, the greatly increased areas under irrigation (which is making another call upon the Forester's activities, since wood is necessary to the cultivator) has already had startling results. It would seem as if the dreaded spectre famine would in the future no longer be a calamity involving the death of hundreds of thousands or millions. In the 1899-1900 famine millions of people sought State relief; in the even more severe failure of the monsoon of 1918 in parts of the country only about one-tenth of the people sought State relief. They found work and, therefore, food for themselves. The afforestation schemes on the hot waste ravine lands on the Jumna in the U.P. were carried out on a larger scale with famine labour at this time.

From the point of view of this history, however, as will be related elsewhere, the notable event was the fine work the Forest Department was able to undertake in dealing with commercial and other vital problems with which the partial closing of the seas by the German submarine campaign, the shortage of tonnage and other causes, had suddenly confronted India. She had to become self-producing in materials for the supply of which she had mainly depended upon imports. In some of these directions the Research Institute and the Forest Department achieved a recognition and found a definite place in the administration of the country which otherwise it might have taken long years to accomplish.

The Great War for a time smoothed over the anarchist movement, to which Lord Hardinge himself was a victim, having had a bomb thrown at him at Delhi which wounded him and killed the attendant behind him on the elephant. At the end of his term of office he was succeeded by Lord Chelmsford in 1916. Under Lord Chelmsford the Indian Army was increased and India assumed responsibility for one hundred millions of the war debt. Indian representatives were invited in 1917 to take part in the Imperial War Conference in London and afterwards at the Peace Conference.

Lord Chelmsford's administration will, however, be remembered by the Constitutional Reforms which resulted from the Montagu-Chelmsford policy of his term of office. The policy originated as follows: In 1916 a movement for Indian Home

Rule was organized in India and culminated in 1917. On August 20th, 1917, a declaration of British policy towards India was enunciated in Parliament by Mr. Montagu, Secretary of State for India. This statement was made on behalf of the British Cabinet, of the India Office and the Government of India. The statement was afterwards fully reproduced in the preamble to the Act of 1919. Mr. Montagu then visited India. During his stay the lines of the proposed policy were laid down by the Secretary of State and Viceroy, and on the return of Mr. Montagu to England the Montagu-Chelmsford Report was issued, recommending far-reaching proposals of reform which were embodied in the Reform Act sanctioned by Parliament in 1919. It would be idle to say that the new proposals were acclaimed. Many experienced officials, both British and Indian, were doubtful as to their outcome. Others, however, with an equal experience were ardent supporters of the new methods to be introduced for administering the country; whilst a section of the Indian community did not consider they went far enough. Perhaps the main danger facing the Reform Act at the time of its introduction lay in the increasing sedition which had become manifest in parts of the country. In 1918 Mr. Justice Rowlatt's Committee on Sedition issued a Report upon this subject, the outcome of which was the introduction of legislation to cope with the growing unrest. This led to increased agitation and to a passive-resistance movement. The position was admittedly a difficult one to deal with since so many involved were merely the tools of expert seditionists. The position was aggravated by the death in February, 1919, of the Amir of Afghanistan, Habibullah Khan. The latter had succeeded his father, Abdurrahman, who had died in 1901. Lord Curzon had kept on good terms with the former, who was accorded the title of "His Majesty" during a visit he paid to Lord Curzon in 1907. After the death of Habibullah, his successor invaded British territory in the hope of being able to fish in troubled waters. The situation after the five-years' strain of the Great War was difficult, but the punitive operations were at length successful. Afghanistan was declared independent of British control.

To return to the Reform Act of 1919. Briefly, its provisions established provincial autonomy in a new form, which came to be known as "Dyarchy." Under this measure certain Departments—Education, Agriculture, the Veterinary Department,

the Roads and Buildings Branch of the Public Works Department and to some extent Health—were to be administered by Indian Ministers directly responsible to their constituents. These Departments were called “transferred” subjects. The Services which remained under the Government of India were the Indian Civil Service, Indian Police, Indian Forest Service, the Irrigation Branch of the Public Works Department and the whole of the Public Works Department in Assam. These Services were known as “Reserved” subjects and the appointments to them and their control remained vested in the Secretary of State for India. Under the Act elected majorities in the Legislative Councils, in the All India Legislative Assembly and in the Council of State were established. Certain powers were reserved to the Governor-General and the Governors of Provinces and important heads of expenditure were theoretically immune from interference. In practice this has not been always the case and both Governor-General and Governors have had to make use of the powers with which the foresight of the framers of the Act provided them. It is not the purpose of this history to deal at greater length with political matters. Burma was not included in the 1919 Act, but it was subsequently made applicable to that Province. The Reformed Councils were inaugurated by the Duke of Connaught who visited India at the close of 1920. “The advantage of the scheme,” wrote Sir Courtenay Ilbert, “over the alternatives proposed by high authorities in India is its elasticity. If and where the list of transferred subjects is considered to be too small it can be increased; if and where it is too large it can be reduced. Whether and how the scheme will work time will show.” Both Burma and Bombay have since relegated their Forest Departments to the “transferred” subject list.

In discussing the double method of Government in the Provinces, Ilbert (in *The New Constitution of India*, by Sir C. Ilbert and Rt. Hon. Lord Meston) wrote: “The responsibility for administrative and legislative action in their own field will be fixed beyond possibility of doubt on Ministers and on the majorities of the provincial legislatures which support them; and they will be given adequate power to fulfil their charge. Similarly within that field for which he remains accountable to Parliament the responsibility for action must be fixed on the Governor in Council and he must possess unfailing means for the discharge of his duties.” The Forest Officer will appreciate

Ilbert's portrayal of his view of the new Reforms: "The new arrangements are to be temporary, provisional, experimental. Growth is what is aimed at—growth, not a static condition. The mode and pace of growth cannot be foreseen with any precision. Any attempt to stereotype them would be fatal to the objects in view. The new Indian Constitution is not so much a new building as a tent. It is like one of those caravan-saries which would be run up rapidly for an Indian prince to meet a temporary need and which could be easily removed or transformed when the need had passed. . . . But the time for striking this tent of ours is still in the future. Our immediate business is to make the best use of it we can. When you look at the Act which embodies this policy you will find that everything has been done to provide elasticity and to facilitate alterations when alterations seem to be needed."

Lord Reading succeeded Lord Chelmsford as Viceroy in 1921. His legal training undoubtedly proved of considerable advantage, and it is probable that no more far-seeing selection could have been made at the time. The period of Lord Reading's Viceroyalty proved a troublesome one. It was marked by the visit of the Prince of Wales during the winter of 1920-1. The non-cooperative movement preached by Gandhi was then passing its most bitter and intense period, and the position of India and of the Reforms themselves were hanging in the balance. The strict justice of the law and the wonderful forbearance and control of the official classes, both British and Indian, together with the wise councils of notable Indians enabled this period to be weathered. By 1925 the waters were less troubled and clearer skies prevailed. In Madras the Moplah (Mappilla) rebellion in Malabar in 1921 proved as dangerous to Indians as to Europeans. Owing to the dense forest conditions of the country the rounding up of the rebels was a matter of considerable difficulty.

The period here under review witnessed various Royal Commissions, Commissions, and Committees visiting India to investigate various points in administration, etc. Their activities so far as they affect the forests are dealt with in the following chapter. Whilst the non-cooperative movement was at its height considerable damage was committed in some of the forests. The effect of the Reforms on the Forest Department so far as at present observable and the troubles experienced during the non-cooperative movement are summarized

from information obtained at the headquarters of the Provinces in 1925.

Bengal.—The Forest Department is a Reserved subject. There is one Conservator who is not a member of the Legislative Council. Under the non-cooperative movement considerable damage was done by fire to the forests and forest buildings in 1922-3 in the Chittagong Civil District. No trouble was experienced in the other Divisions.

United Provinces.—Under the Legislative Council the work of the Forest Department has been subjected to a great deal of criticism from outside opinion which did not exist before. The policy of the Government in Kumaun (the Kumaun Forests were made Reserved Forests in 1915) has met with violent and sustained opposition since the introduction of the Reforms leading to the abandonment of the Utilization Circle. As regards the other Forest Circles of the Province no complaints have been made. The Council has also evinced parsimony towards the forest budgets restricting much-needed development.

As a result of the non-cooperative movement large tracts of forests were wilfully burnt in Kumaun, thus destroying many years of careful work by the Department. The Chief Conservator is a Member of the Legislative Council.

Punjab.—The new regime has had no special effect on the Forest Department except that budget and financial control have been tightened, and consequently the work under these heads has been considerably increased. This, however, would not affect the Department adversely if the Councillors who have to pass the budgets would take a real interest in Forest matters and would try to understand them. There have been some misapprehensions about the Forest Department among the non-official members of the Legislative Council, such as that the Forest Department is a wasteful Department, and the budget has been sometimes reluctantly passed; but these misapprehensions are now said to be disappearing as time passes on and the functions of the Forest Department are being made clear to the people. Non-cooperation has not had any marked effect on the Forest Departmental working. The Chief Conservator is a Member of the Legislative Council.

Burma.—In Burma the Forest Department is a "transferred" subject and is now directly in charge of the Minister for Agriculture, Excise and Forests. Heads of the Departments

are Members of the Legislative Council. The non-cooperative movement had no effect on the forests.

Bihar and Orissa.—During the height of the non-cooperative movement in 1921-2 a larger proportion of the forests were burnt in the annual fires, but it was not certain that this was due to wilful firing. In Puri there were a number of raids on the forests and trees were cut down. In common with other Provinces, where such raids were made, it was attributed to the impression amongst the populace that the British Raj had come to an end.

Assam.—Under the non-cooperative movement there was some trouble in Kamrup, and in Goalpara all the forest villages went on strike, instigated thereto by agitators.

Central Provinces.—In these Provinces the position of the Department is very much the same as before the introduction of the Reform Act. The Chief Conservator of Forests is not a Member of the Legislative Council. Some trouble was experienced in January, 1922, in South Raipur from the non-cooperative movement, the people entering the forests and committing damage, under the impression that all authority on the part of Government had ceased. In most Divisions a larger proportion of fires occurred, attributed to the same cause.

Madras.—The difficulty complained of in Madras was the long delay experienced in getting new proposals requiring financial aid through the Legislative Council. The Chief Conservator may be a Member of the Legislative Council. In the Quinquennial Review of Forest Administration ending 1923-4 the following appears: "The non-cooperative campaign brought about organized defiance of the forest law. This was especially serious in the Guntur District, where many cases of violence against forest officials occurred. Several Forest Guards were murdered. The definite break-down of the movement towards the close of the quinquennium had an important reaction for the better on forest protection. Lawlessness was much less in evidence, the change being especially marked in Guntur. During the Mappilla rebellion in 1921 the Nilambur Division was for several months in the hands of the rebels. The District Forest Officer and his subordinates had narrow escapes from death; work was entirely dislocated and most of the buildings were destroyed or badly damaged."

Bombay.—The Forest Department is a "transferred"

subject. The Chief Conservator is not usually a Member of the Legislative Council. Since 1921 the Presidency, which was outside the sphere of the Inspector-General of Forests, has been included therein for the purpose of technical advice. A period of agitation of all kinds commenced at a time coincident with the introduction of the Reforms. The year 1920-1 was a year of bad fires, especially in the Southern Circle. The attitude of the people has improved a great deal since then. The agitation against the Department was strongest in Kanara, aided by the non-cooperative movement. A Forest Settlement Officer was appointed in consequence to enquire into the complaints. A grievances Committee has recently been instituted to adjudicate on Forest grievances.

The chief troubles in connection with the administration of the country under the Reform Act have been due to the desire expressed by a certain section of Indian politicians for an acceleration of the Indianization of the Services and of local self-government. These matters, in so far as they concern the management of the Forest Estate, come up for consideration in the following chapters.

Lord Reading's period of service comes to an end early in 1926. The selection of the Right Honourable Edward F. L. Wood, M.P., British Minister of Agriculture, as the Viceroy-Elect, was announced on October 30th, 1925. Mr. Wood is the grandson of Sir Charles Wood, first Lord Halifax, who was President of the Board of Control from 1852-5 and First Secretary of State for India from 1859-66. It was due to Sir Charles Wood's untiring vigilance and extraordinary knowledge on forestry subjects, then a dead letter in England, that the infant Forest Department made such good progress during the first difficult years under Brandis. That this was the case has been abundantly shown in this history (cf. I, p. 530 and many references in Vol. II).

CHAPTER XII

THE PROGRESS OF FOREST ADMINISTRATION IN BRITISH INDIA AND BURMA, 1901-25

IN the second part of the second volume of this history a general review was given of the progress made by the Department between 1871 and 1900. A survey of progress during the first quarter of the present century will be now attempted. That the Department has made a noteworthy advance in the practice of scientific forestry will become evident from the sequence and the subjects dealt with in this Part. In the review in the second volume such items as the State proprietorship in the land, Forest Laws, Settlements, Demarcation, Surveys, Exploitation and Protection took precedence, the progress made in silviculture, Working Plans and research having been comparatively small. During the succeeding quarter of a century the position was reversed. As mentioned in Volume II (p. 463), a period of stagnation followed the completion, for the most part, of the above-enumerated work. This was terminated by what may be termed the renaissance of silviculture and much else besides, due to the introduction of Research which, as has been strikingly demonstrated, had been delayed far too long. In the present Part chapters on Research, Silviculture and Working Plans take the premier position, a position this professional work now occupies in many Provinces in the country. Some areas, it is true, are lamentably backward; in others the old ideas that revenue-making and the balance-sheet can be the only justification for according larger grants to the Department still remain supreme. But this old fetish is dying and, unquestionably, faith in the value of research as a potential factor in the financial improvement of the Forest Estate has become an established fact.

Full recognition has been accorded in this history to the great work undertaken by the first three Inspectors-General, who were of German nationality. They brought the Department

into being and established a Forest Administration in the country. But the rigid lines upon which German forestry was conducted, lines which modern German Foresters now realize were not in all things in conformance with nature, did not afford sufficient elasticity for Indian requirements or, in its broad sense, for tropical forestry. It is significant that the scientific application to Indian conditions of the training the Forest Officer receives has eventuated during the administration of English Inspectors-General. And the position achieved, as these pages will show, is remarkable if it be taken to date, as history will, it is believed, unerringly date it from the year 1906, when the Secretary of State (Lord Morley), in a memorable Despatch, No. 61—Rev., dated 23rd March, 1906, sanctioned the formation of the Imperial Forest Research Institute. But even the far-seeing statesmanship which provided the Department with the one thing needed, combined as it was with long-delayed reorganizations and improvement of salaries, to enable it to undertake the work its officers were trained for could not have anticipated the results achieved in two short decades. For no Forest Officer of the time and even a decade later foresaw the extraordinary development which, aided admittedly by War demands, was to take place.

It will be remembered that Ribbentrop, the last of the German Inspectors-General, retired in 1900 and was succeeded by Mr. H. C. Hill, C.I.E. Hill, after a bare two-years' service, of which the last few months were spent on furlough, died suddenly at home. Mr. R. C. Wroughton had been appointed to officiate for Hill on 20th April, 1902. Shortly after Hill's death in 1902 Wroughton proceeded on furlough and then retired. Mr. (now Sir Sainthill) Eardley Wilmot, K.C.I.E., was called from Burma, where he was Conservator of Forests, and was appointed Inspector-General on the 4th February, 1903. Eardley Wilmot was succeeded on 9th November, 1908, by Mr. F. Beadon Bryant, C.S.I., who retired on 4th April, 1913, to be succeeded by Mr. (now Sir George) Hart, K.B.E., C.I.E. Hart was followed on 23rd February, 1921, by Mr. (now Sir Peter) Clutterbuck, C.I.E., C.B.E., V.D., who still holds the post (1925). During the period the following officiated as Inspectors-General: Mr. J. H. Lace, C.I.E., from 17th April, 1907, to 16th July, 1907; Mr. L. Mercer, C.I.E., from 31st August to 30th November, 1911; Mr. M. Hill, C.I.E., from 30th March, 1914, to 9th October, 1914; Sir Peter Clutterbuck from 26th May, 1919, to 27th October, 1919.

With the increasing work which the administration of the forests threw upon the staff it became necessary to subdivide the Circles and, as a consequence, increase the number of Conservatorships in the larger Provinces. These additions gave rise to confusion owing to the number of independent heads in charge of Forest Administration in a Province. It is true that in a Province where there was more than one Circle the Secretariat had to some extent endeavoured to take the opinion on technical matters of the Senior Conservator; but this did not obviate friction, since the Senior Conservator had no authority over the other Conservators. In 1904, when Burma had four Conservators—Messrs. F. B. Manson, F. Beadon-Bryant, T. A. Hauxwell and H. Slade—these officers drew up a Memorandum, dated 26th April, 1904, suggesting that a post of Deputy Inspector-General should be formed in the Province. The history of this proposal is of interest, and since the arguments in its favour were, or became, common to all the Provinces it is necessary to briefly review it. The Burma proposal was no new one. It had been first suggested sixteen years before. On his transfer to Upper Burma in 1887 (after the third Burmese War) Mr. H. C. Hill was made Secretary to the Chief Commissioner in Forest matters and held the post for two years, when he quitted the Province. Before Hill left, however, in 1888, Sir Charles Crosthwaite (No. 992, 31 B., dated 27th August) recommended the appointment of a Deputy Inspector-General of Forests in Burma. The suggestion was not approved (G. of I. letter, No. 381 F., dated 31st (30th?) April). Ten years later Ribbentrop, Inspector-General of Forests (No. 1227, dated 11th October, 1898), advocated a return to the arrangement in force between 1887 and 1889. Sir Frederick Fryer, the Lieutenant-Governor, was not in favour of the proposal and made certain alternative suggestions (letter No. 495, 2 A., 23, dated 21st December, 1898). He was unable to recommend the step owing to "the difficulty in defining the respective jurisdictions of the Inspector-General and the new Deputy Inspector-General." He proposed the appointment of "a Conservator who would be Forest Secretary and would control the Rangoon Depot, but would have no territorial jurisdiction." No further action was taken until the Burma Conservators drafted their Memorandum of 1904. Sir F. Fryer's main objection had been that as the system of issuing purchase contracts for the extraction of teak was to be continued the time was not ripe for

appointment of a D.I.G. Forests. In their letter to the Government of India (F.D. No. 66—2A.—27, dated 4th August, 1904) recommending the proposal the Government of Burma, after recapitulating the history above given, wrote : “ The system of exploitation by private agency is still maintained in many of the forests, but, nevertheless, it is impossible to avoid the conclusion that the forest work of the Province has greatly increased in volume and still more in complexity in recent years. The extraction of teak timber, both by departmental and by private agency, is being more closely controlled and supervised year by year by the Forest Department. The preparation of Working Plans, the protection of the Reserved Forests from fire and silvicultural operations of all kinds occupy more and more of the attention of Forest Officers, and as a result the questions presented to the Local Government are more technical in character and more difficult of solution. It is the opinion of all the Conservators in the Province that the work in several of the larger Forest Divisions has grown to an extent which it is beyond the power of the Divisional Forest Officer to efficiently control, and that a rearrangement and increase of divisional and possibly of Conservator's charges is required in order to place the department on a sound footing. Proposals to bring the Arakan Civil Division under the administration of the Forest Department and to form it into a Forest Division have already been submitted to the Government of India with my letter No. 455—1 M.—11, dated 15th June, 1904 ; it is not improbable that more than one Division will ultimately be required in Arakan, suggestions by the Conservators concerned to form two new Divisions from the Tharrawaddy and Salween Divisions respectively are at present before the Lieutenant-Governor, and proposals in the same direction for splitting up certain other Divisions are being drafted by Conservators. The revision of the divisional charges will necessitate a reorganization of the Forest Services in the Province and the whole subject is one which needs to be thoroughly and carefully taken up on uniform lines for the whole Province by one officer as the head of the Forest Department in Burma. In paragraphs 4 to 6 of their letter the Conservators emphasize the need for a central authority in the Province on technical and administrative matters to whom they can themselves apply for advice, and they consider that the absence of such an authority retards the development of the Forests of Burma.

In these views the Lieutenant-Governor entirely concurs." The latter was Sir Hugh Barnes, and his letter admirably marshals the arguments in favour of the appointment. He instances the fact that Burma possessed magnificent forests, and it was necessary to find markets for species other than teak, yet he had noticed that the Port Commissioners, who were carrying out extensive Port improvements in Rangoon, "have lately imported large quantities of Jarrah timbers from Australia for their new wharves. Pyinkado (*Xylia dolabriformis*) is admitted to be a better wood for the purpose, and there are quantities of it to be found in Burma, but the Port Commissioners were unable to obtain it in the form required. Similarly the discovery and exploitation in such a manner that it can be readily procurable of a good cheap building timber to take the place of the expensive teak now almost universally used by the Public Works Department would effect a very great saving in expenditure." Sir Hugh agreed with the Conservators that the Deputy Inspector-General should not be the Secretary for Forest matters to the Local Government since it was desirable that he should tour constantly, which would not be possible if he was buried in the Secretariat. Nor was the opinion held in Burma that the appointment would in any way conflict with the powers and duties of the Inspector-General of Forests. In the Government of India letter (129, dated 20th April, 1905) to the Secretary of State (St. John Brodrick) the Burma Government's proposal was strongly supported. It was suggested, however, that the title be changed to Conservator-General. Eardley Wilmot was Inspector-General, and, evidently on his advice, the Government of India add: "and we would also transfer to the Conservator-General the control of all *sanctioned* Working Plans in Burma and thus relieve our Inspector-General of a portion of his increasingly burdensome work." The Secretary of State (79 (Revenue), dated 2nd June, 1905) sanctioned the proposal and also settled the title of the new post in the following: "Your proposal is sanctioned, but with reference to your remarks as to the most suitable designation of the new officer I suggest for your consideration whether 'Chief Conservator' might not more appropriately describe the functions to be assigned to the officer in question."

As an outcome of the Burma proposal, and owing to a reorganization of the Imperial Forest Service being under

consideration in 1905, the Government of India suggested to the Local Governments that in every Province in which there were three or more Conservators of Forests a post of Conservator-General (Chief Conservator) should be created. The Government of Madras considered at the time that such an appointment was unnecessary, but the suggestion was accepted by the Government of Bombay and by the Central Provinces Administration. On receipt of the sanction of the Secretary of State to the Burma post the Government of India recommended (in 1905) that posts of Chief Conservators should be created in Bombay and the Central Provinces. Lord Morley had now become Secretary of State, and he intimated that he was not satisfied that a Chief Conservator was required for Bombay or the Central Provinces. He pointed out that there were special reasons for such an appointment in Burma, and considered not only that some experience of the working of the system was desirable, but also that the extension of the experiment should be dealt with on its merits as an administrative arrangement and not as part of a scheme of service relief. This decision was communicated to the Local Governments concerned and the matter was dropped for the time being. In the Quinquennial Review of Forest Administration (1909-10 to 1913-14) this matter is alluded to "These latter posts (Chief Conservators) are of somewhat recent date, having been created in Burma in 1905 and in the Central Provinces, provisionally, in 1906 and, permanently, in 1911. But the experience gained during the past ten years has been sufficient to show that the appointments were fully justified both on financial and administrative grounds. Technical work is co-ordinated; one adviser, in place of several, is given to the Local Government; and forest revenue increases. Recently a Chief Conservator has been sanctioned for Bombay, and the creation of a similar appointment for the United Provinces is now under consideration." The increase of the cadre of Conservators including Conservators of Working Plans and Utilization, an entirely new departure, in the Provinces during the period was as follows :

Burma.—This Province had four sanctioned posts of Conservator in 1901. A Chief Conservatorship was sanctioned in 1905. Five more posts of Conservator were sanctioned in 1920, including a Conservator of Working Plans and a Utilization Conservator.

Bombay.—In 1901 there were three sanctioned Conservators'

posts. A Chief Conservator was added in 1914 and three more posts of Conservator in 1921.

Madras.—There were three sanctioned posts of Conservator in 1901 in the Presidency. Another post was added under the reorganization scheme approved in 1911. A post of Chief Conservator was sanctioned in 1917 and two additional Conservators' posts in 1921.

Central Provinces.—There were three Conservators' posts in 1901. The Secretary of State (Despatch No. 133—Rev., dated 27th July, 1906) sanctioned the appointment of a Chief Conservator for a period of five years, and later accorded sanction (Despatch No. 73—Rev., dated 21st July, 1911) to the appointment as a permanent measure. No additional Conservator's appointments have been sanctioned.

United Provinces.—The reorganization of 1908 gave two Conservators who continued under the scheme of 1914 without addition. A Chief Conservator was sanctioned in 1915 and three Conservators were added during the years that followed: (1) For the newly formed Kumaun Circle when the Kumaun Forests were at length, after a period of forty years, formed into Reserves. This post was created for two years in 1916 and made permanent in 1918. (2) Utilization Circle, February, 1919, and (3) Working Plan and Sylvicultural Research Circle—formed for two years in 1920 and made permanent in 1922. Of these the Utilization Circle is at present held in abeyance.

The Conservators' posts for Working Plans and Utilization were the first to be formed in India, and the U.P. has the honour of having founded them at the instance of Clutterbuck.

Punjab.—In 1901 there was a single Conservator in the Province. A scheme involving *inter alia* the creation of an appointment of a second Conservator was put forward in 1909, but the Secretary of State was unable to accept the proposal and the Local Government was requested to reconsider their application in the light of his remarks. Revised proposals were submitted in 1917, and although doubts were expressed on the adequacy of the scheme, the second Conservatorship was then sanctioned. A few years later the position was reviewed and posts of a Chief Conservator and a Utilization Conservator were sanctioned in 1921.

Assam.—One Conservator managed the forests in 1910. A second was added in 1908. Only one appointment of Conservator was, however, allotted to Assam after the

administrative changes which took place in 1912. In that year the question arose of adding a second Conservatorship to the Province as newly constituted. This proposal was eventually sanctioned by the Secretary of State in October, 1912. The Assam Government have recently suggested (1925) the holding in abeyance of the second post of Conservator, and the proposal has, it is understood, been forwarded to the Secretary of State—a rather retrograde step; for Assam is the most backward Province in India, and its permanent division into two Circles should result in the great forests of this Province being opened out in the light of modern practice.

Bengal.—There has been no change in Bengal. Under the schemes it lost some of its Divisions and has remained under a single Conservator (1925).

Bihar and Orissa.—A Province formed after the redistribution of territories, as it was officially termed, on 1st April, 1912. One post of Conservator was sanctioned for the newly constituted Province and remained the only post in 1925.

Thus, whereas in 1901 there were, in addition to the Inspector-General, eighteen Conservators' posts in India and Burma, in 1925 the number had increased to thirty-six posts with six posts of Chief Conservator, omitting the President of the Research Institute at Dehra Dun. The post of Inspector-General still remained with the Government of India. In addition the post of President of the Research Institute and College at Dehra Dun held the rank till January, 1925, of Chief Conservator. This latter rank is no longer attached to the post of President, although in fact he has relatively (with free house allowance) the salary of a Chief Conservator and the precedence. The mere enumeration of the large number of extra administrative posts which the growth of the Department has necessitated is in itself an indication of the great expansion and success of the work performed. Proceeding step by step with the subdivision of Circles in the Provinces a far greater subdivision of the Forest Divisions has taken place throughout the country necessitated by the more intensive management. I may quote two instances from my own personal knowledge. Towards the beginning of 1897 I was in the old Singbhum Division of Bengal; at the close of the year I was appointed to the charge of the Chittagong Division, each then being a single Division. In 1925, on my return to India, I found these Divisions split up into four and three respectively!

The sanctioned scale of the Imperial Forest Service in 1900

was given on page 491 in Volume II, the total number of appointments being then 213.

The first considerable increases in staff and pay of the Department during the period were the result of the consideration given to this matter and proposals put forward by Eardley Wilmot when Inspector-General. The Quinquennial Review of 1904-5 to 1908-9 has the following summary: "The period under report has been marked both by a considerable increase in the number of officers in all branches of the Forest Service and by a general improvement in the conditions of service. The pay of the administrative and executive branches of the Imperial Forest Service has been improved, and for the latter a scale of pay based on length of service has been introduced in place of the system of promotion from grade to grade. A similar system for the Provincial Service has been under consideration by the Government of India. . . . The posts added to the ultimate strength of the various Provincial cadres were as follows: Research Institute and College—Imperial Service, 0; Provincial Service, 2. Burma—Imperial Service, 23 (1 Chief Conservator); Provincial Service, 28. Madras—Imperial Service, 2; Provincial Service, 0; Bombay—Imperial Service, 2; Provincial Service, 3; United Provinces—Imperial Service, 5; Provincial Service, 0. Central Provinces—Imperial Service, 2; Provincial Service, 11. Bengal—Imperial Service, 0; Provincial Service, 1. E. Bengal and Assam—Imperial Service, 5; Provincial Service, 10. Punjab—Imperial Service, 1; Provincial Service, 0. Andamans—Imperial Service, 0; Provincial Service, 3. Total—Imperial Service, 40; Provincial Service, 58.

These comprise thirteen India list posts (including some additional posts added to the Research Institute and College Staff) which, together with a leave and training reserve of three posts, have been allotted to the various Provincial cadres, and additions due to reorganizations of the cadres in the Provinces mentioned, except Madras and the Punjab, for which Provinces reorganizations of the Imperial and Provincial cadres have been under consideration by the Government of India. Considerable additions have also been made to the subordinate and clerical staffs in several Provinces."

Under 'Strength of Staff' in the following quinquennium the following is recorded: "The increasing activities of the Department have rendered necessary considerable additions to the staff. The sanctioned strength of the Imperial Service

increased from 205 to 214 and the actual strength from 196 to 237. In the case of the Provincial Service the sanctioned strength (excluding probationers) increased from 194 to 213, and the number employed from 160 to 197. In addition 32 Probationary Extra Assistant Conservators were employed at the close of the quinquennium. . . . Considerable additions were made to the subordinate and clerical staffs in several Provinces." There are some interesting remarks on the organization of the Provincial Service: "Up to the year 1906 members of the Provincial Service were recruited by the promotion of men who had served for a period as Rangers. In 1906, with the object of raising the standard of the Provincial Service, a system of direct appointment was introduced and the candidates chosen, either Rangers already in the Service or young men of good education and social standing, were required to undergo a third year of training at Dehra Dun in addition to the ordinary course of two years. On the completion of this course and of three years' approved service, either as Ranger or Probationary Extra Assistant Conservator, the candidate became eligible for permanent promotion to the Provincial Service. This system, which was at best a temporary measure, proved unsatisfactory, and in 1912 a separate two-years' course for Provincial Service candidates was prescribed. There can be no doubt that this is a great improvement on the old method of recruitment, but the candidates selected for training have not always been of the standard required and the Government of India desire to impress on Local Governments and Administrations the importance of careful selection." This matter is considered in greater detail in a subsequent chapter. As a matter of fact it resulted in considerable hardship and heart burning amongst the Ranger staff, who form the backbone of the staff of the Divisional Officer. The restriction to promoting Rangers was withdrawn later.

Another new departure is also commented upon. "An important reform effected in 1910 was the constitution of a Board of Forestry, composed of representative Conservators and Chief Conservators under the Presidency of the Inspector-General of Forests. Meetings are held at intervals of three years when the programme of research work is considered and questions connected with the Research Institute and College and forest administration generally are discussed. Meetings were held in 1910 and 1913. As a means

of putting the cause of forest education and research, of stimulating commercial exploitation, of co-ordinating work and of interchanging ideas, the Board of Forestry has already proved its value. With the creation of this Board, the old Board of Control of the Imperial Forest College was abolished."

The Islington Public Services Commission wrote its Report in 1915 and made proposals on the subject of the reorganization of the Department. Owing to the war the proposals were not given effect to during the following quinquennium, 1914-15 to 1918-19. Before considering their resultant effect, and that of the War years, on the Department, and the period succeeding the Armistice in November, 1918, the following suggestive paragraphs from the War Quinquennium Report merit quotation: "Standing at 214 at the beginning of the period the sanctioned strength of the Imperial Service increased to 259 (1918-19) though the actual strength at the end of the period amounted to only 217 against 237 at the commencement. Against 73 in the previous five years only 15 recruits were appointed during the quinquennium, and of these several, who were under training on the outbreak of the War, did not join their appointment until after its conclusion. The increased demand for timber and other forest products brought about by war conditions has undoubtedly greatly stimulated forest development in the Indian Empire, and large schemes of reorganization are under consideration. Circles and divisional charges must be divided up if development is to proceed, while it is also necessary to provide special posts for utilization, Working Plans and research work in the Provinces, as well as to augment largely the staff of the Central Research Institute. It is to be feared, however, that some time must elapse before the men to fill the new posts can be provided and, owing to the time taken to train recruits, immediate recovery even in respect of the present sanctioned staff is impossible. The sanctioned strength of the Provincial Service has increased from 213 to 265 and the number actually employed from 197 to 254, the latter figure including 28 Probationary Extra Assistant Conservators of Forests. There have also been increases in the Ranger, other subordinate and clerical establishments.

Exclusive of officers placed on special duty in connection with work of military importance, 70 officers of the Imperial Service and 13 of the Provincial Service were permitted to join the forces. Of these the loss of 8 officers either in action,

or as a result of wounds, or of sickness developed while on military service, has to be deplored."

It will be necessary to consider the action taken on the recommendations of the Islington Commission, and the subsequent steps rendered necessary by the Reforms of 1919, and the demands made for the Indianization of the Services.

The general position of the Forest Department in 1923 was detailed in a "Memorandum for the use of the Royal Commission on the Public Services" (Lee Commission) printed in November, 1923. The only alteration to the constitution of the Department was the addition of a Forest Engineering Service sanctioned in 1919 at a time when the world was obsessed with the idea that the *Deus ex machina* of the future was the Engineer. As a matter of fact, only one year was recruited and trained in Canada and the United States, and the idea of maintaining a separate cadre for this branch appears to be already exploded, and Local Governments are organizing their own Engineering Divisions. That the appearance of the expert in Forest Engineering has been of inestimable value to the Department is indisputable. But to be of real value, it may be suggested, he must be a Forest Engineer imbued with the ideas pertaining to forest finance and expenditure as against those ordinarily held by the Engineer who belongs to a spending Department and is trained as such.

Some alterations in procedure had taken place in recent years after the introduction of the new Reforms. "Local Governments may now make promotions to any post borne on the provincial cadre of the Service, save that, in Provinces other than Madras and Bombay, promotions to the posts of Chief Conservator and Conservator require the previous approval of the Governor-General in Council. This rule is, however, unworkable, since all Conservators in Provinces other than Madras and Bombay are borne on a general list and a vacancy occurring in one Province is not necessarily filled by promotion of an officer on the cadre of that Province. In practice the procedure previously in force under Article 19 of the Forest Department Code, 7th edition, whereby such promotions are made by the Government of India, is still adhered to. In consequence of the decisions on the proposals of the Islington Commission, promotion to the administrative ranks is now made strictly by selection on the grounds of merit and not by seniority. Officers of the Provincial Forest Service are now eligible for promotion to the Indian Forest

Service, and, if promoted, enter the time-scale of pay of the latter at the point next above the pay, other than the special pay drawn prior to promotion, but receive advance increments of pay sufficient to compensate them for any loss they may otherwise incur, the advance increments being reduced by any amount by which the recipient's pay may be increased until the original increment is extinguished. They are given rank and place in the General List of the Indian Forest Service according to the pay they receive on promotion. They are liable to serve in any Province, but Indians are not ordinarily transferred to Burma. They are eligible for promotion to administrative rank equally with directly recruited members of the Indian Forest Service. If promoted to administrative rank they are paid on the same scale as officers directly recruited. If a local Government is unable to find a suitable man from its own Provincial Service to fill a vacant 'listed' post in the Indian Forest Service it is at liberty to obtain an officer from another Province." The method of recruiting and training probationers for the Service is dealt with in the next chapter.

The Islington Commission recommended alterations in the time-scale of pay for Assistant and Deputy Conservators, as also for the higher salaried officers. Before these proposals could be given effect to, the increased cost of living, which the War and its aftermath had brought about, necessitated some reconsideration of the suggestions. The rates brought into force in December, 1919, as existing in 1923 were as follows : The time-scale for Assistant and Deputy Conservators commenced at Rs.375 per mensem for the first two years, rising by annual increments of Rs.50 per mensem to Rs.1350 per mensem in the twenty-second year of service. An efficiency bar was introduced at Rs.725, the next increase being to Rs.800. In the twelfth year Rs.900 is attained, there being no rise in the thirteenth year, after which the increases are yearly to the twenty-second year. After this year additional emoluments depend upon promotion to Conservator's rank. In addition to the above pay an overseas allowance of Rs.150 per mensem is granted during the first six years' service, Rs.200 per mensem for the next three years, and thereafter Rs.250 per mensem up to the twenty-second year, continuing until the officer is promoted to Administrative rank. At the same time rates of pay for Conservators were altered to an incremental scale of Rs.1750-50-2000, the previous system

of grades being abolished, for Chief Conservators to an incremental scale of Rs.2500-125-2750, and the pay of the Inspector-General of Forests was raised to Rs.3250 a month. No overseas allowance is drawn by Conservators, Chief Conservators, or Inspector-General. The Memorandum contains the following note: "The overseas allowance, which counts as pay for pension, leave, etc., is granted only to officers of European

I	2	3	4	5	6	7	8	9
Provinces.	Number of major posts.	India list posts.	Total.	12½ per cent of column 4 reserved for promoted Provincial Service officers.	Leave and training reserve at 25% of column 4—column 5.	Leave reserve of promoted Provincial Forest Service officers at 14 per cent of column 5.	TOTAL. Directly recruited officers, columns 4-5+6. Promoted Provincial Service officers, columns 5+7.	Grand total.
Madras (with Coorg)	49	3	52	7	11	1	56 8	64
Bombay	32	2	34	4	8	1	38 5	43
Bengal	15	2	17	2	4	0	19 2	21
U.P. (with Ajmir)	30	3	33	4	7	1	36 5	41
Punjab (with Baluchistan and N.W. Frontier Province)	29	2	31	4	7	1	34 5	39
Bihar and Orissa	13	1	14	2	3	0	15 2	17
Assam	17	1	18	2	4	0	20 2	22
Central Provinces	24	2	26	3	6	0	29 3	32
Forest Research Institute, Dehra Dun	—	1	1	—	—	—	1 —	1
Total for India (excluding Burma)	209	17	226	28	50	4	248 32	280
Burma	90	6	96	12	21	2	105 14	119
	299	23	322	40	71	6	353 46	399

domicile, but officers of Indian domicile already in the Service in 1920, as well as those who were then being trained as probationers, receive consolidated pay." The latter came to the same amount as drawn by their European confrères. Up to and including the sixth year of service (Rs.525) officers are styled Assistant Conservators; on reaching the Rs.575 scale they became Deputy Conservators. Local Governments are empowered to stop the incremental rise in the case of officers whose service is unsatisfactory, and to an officer at the

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efficiency bar until he is declared fit to hold one of the heaviest major charges of the Province. A comparison with the scales of pay shown on p. 491 in Vol. II is instructive. The opinion may be expressed that the Forest Department is now the finest Service in India for men whose tastes run to Science and an open-air life. Pensions have been considerably improved, and an officer now receives four free passages for himself and wife during his service. He may also take up to eight months' furlough on full pay.

The proposals for the Indianization of the Service are dealt with in the following chapter.

The sanctioned strength of the Service in 1923 is shown in the statement on p. 274, it being remembered that the provincial cadres were organized between 1916 and 1921.

The actual number of officers in the Service on the 1st July, 1923, was 306. Of these, 255 were directly recruited Europeans, 5 promoted Europeans of non-Asiatic domicile and 46 Indians. Of the latter, 27 were Indians of unmixed descent and 19 Anglo-Indians or statutory natives of India. The annual rate of recruitment is now fixed at 4·37 per cent of the sanctioned cadre of 353 directly recruited officers, or 15 yearly.

The position of appointments in the Service in 1925 was shown in Appendix II to the "Regulations for the appointment in India of probationers for the Indian Forest Service in 1925." It reads as follows :

<i>Appointment.</i>	<i>Salary.</i>
(a) 1 Inspector-General of Forests . . .	Rs.3250 a month.
(b) 1 Asst. Inspector-General of Forests . . .	Vacant.
(c) 6 Chief Conservators . (Bombay, Madras, U.P., Punjab, Burma, and C.P.)	Commencing at Rs.2500 and rising by annual increments of Rs.125 to Rs.2750 a month.
(d) 1 President, Forest Re- search Institute and College . . .	Rs.2500 a month.
(e) 36 Conservators . . .	Commencing at Rs.1750 and rising by annual increments of Rs.100 to Rs.2150 a month.

(f) 308 Deputy and Assistant — Conservators . .	Rs.325 a month, rising by annual increments of Rs.50 a month to Rs.725 a month in the ninth year; thereafter, Rs.800 in the tenth year, rising by annual increments of Rs.50 to Rs.900 in the twelfth and thirteenth years, and Rs.1350 in the twenty- second year; no officer to draw more than Rs.725 a month until he is declared by the Local Government to be fit to hold one of the heaviest major charges in the Province in which he is serving.
Total 353 —	

Probationers trained in the United Kingdom will, on appointment to the Indian Forest Service as Assistant Conservators, draw pay from the date on which they report their arrival in India.

The position of the Provincial Service in 1923 (Memorandum above quoted) was as follows :

" As a result of the orders passed on the recommendations of the Islington Commission all Extra Deputy Conservators of Forests who were considered to be fully qualified to hold a major charge were transferred to the Indian Forest Service from the 12th March, 1920, and now hold ' listed ' posts in the cadre of that Service. Those not so promoted continue to be styled as Extra Deputy Conservators. Except for these unpromoted officers, of whom there were five on the 1st July, 1923, the class of Extra Deputy Conservators has been abolished and the Service consists of Extra Assistant Conservators only. . . . Officers of the Provincial Service are eligible for promotion to 12½ per cent of the posts in the Indian Forest Service, such promotion being made by local Governments solely on the grounds of exceptional merit, irrespective of seniority, except in the case of Extra Deputy Conservators hitherto unpromoted who may be promoted by the same authorities if considered to be qualified to hold a major charge. Further representations for the removal of the prefix ' Extra ' from the designation of officers of this Service have been received, but it has been decided not to make any change, since it is desirable to maintain a distinction between

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officers of the Indian Forest and Provincial Services, and no suitable alternative designation not identical with any adopted in an all-India Service is known. The recruitment and training of officers of the Provincial Service is now a matter for regulation by the various local Governments. . . . As a consequence of the grant of enhanced financial powers from 1st April, 1921, it now rests with the Provincial Governments, subject to the proviso that the maximum rate of pay of a permanent post shall not exceed Rs.1,200 a month, to determine the pay of the Provincial Forest Service."

"The strength of the Provincial Service, which is determined in each province by the local Government concerned, was on the 1st July, 1923, as follows :

Province.	Sanction'd strength.	Actual strength.	No. of vacancies.	Probationers (a).
Assam	10	9	1	3
Bengal	13	11	2	2
Bihar and Orissa	8	8	—	3
Bombay	24	21	3	6
Central Provinces	23	24(b)	—	6
Madras	42	40	2	3
Punjab	33	27	6	—
United Provinces	35	33	2	—
Total India (excluding Burma)	188	173(b)	16	23
Burma	113	50	63	26
Grand Total	301	223	79	49

(a) Not included in actual strength. There is no fixed scale of such Probationary Extra Assistant Conservators.

(b) One Supernumerary."

The *Areas* over which the Staff carries out its varied duties are very considerable, as the following figures indicate. In 1922-3 the total area of forests in square miles under the control of the Department was as follows :

Bengal—Reserved Forest, 4909; Protected Forest, 1702; Unclassed State Forest, 4030. Total, 10,641, or 13.5 per cent of area of Province. *U.P.*—Reserved, 7373; Protected, 4;

Unclassed State, 37. Total, 7414, or 6.9 per cent. *Punjab*—Reserved, 1684; Protected, 4035; Unclassed State, 519. Total, 6238, or 6.4 per cent. *Burma*—Reserved, 27,416; Unclassed State, 92,525 (excluding 21,527 square miles of Unclassed in the Federated Shan States). Total, 119,941, or 49.3 per cent. *Bihar and Orissa*—Reserved, 1754; Protected, 1033 (excluding 1036 square miles not under control of Department); Unclassed State, 8. Total, 2795, or 3.3 per cent. *Assam*—Reserved, 5601; Unclassed State, 15,630. Total, 21,231, or 41.0 per cent. *C.P. and Berar*—Reserved, 19,785. Total, 19,785, or 19.8 per cent. *Coorg*—Reserved, 520, or 32.9 per cent. *N.W. Frontier Province*—Reserved, 236; Unclassed State, 9. Total, 245, or 1.9 per cent. *Ajmere*—Reserved, 142, or 5.1 per cent. *Baluchistan*—Reserved, 313; Unclassed State, 472. Total, 785, or 1.4 per cent. *Andamans and Nicobars*—Reserved, 85; Unclassed State, 2122. Total, 2207, or 70.2 per cent. *Madras*—Reserved, 19,064; Reserved Lands, 192. Total, 19,256, or 13.5 per cent. *Bombay and Sind*—Reserved, 12,040 (excludes 1833 square miles in charge of Revenue Department); Protected, 464 (excludes 659 square miles under Revenue Department). Total, 12,504, or 10.1 per cent.

Total Areas for India and Burma—Reserves, 100,922; Protected, 7238; Unclassed State, 115,544. Grand Total, 223,704 square miles, or 20.3 per cent of total area of British India with Burma.

[N.B.—Owing to the colonization schemes due to the irrigation projects in the Punjab, considerable areas of *rakh* land are being given back to the Revenue Authorities. From this cause the area of Reserves had fallen to 1297 square miles in 1923-4.]

Forest Settlements have made considerable progress during the period under review. The position in the Provinces was as follows in 1923-4:

Bengal—All rights have been settled in Reserved Forests. The Protected Forests are practically in the same position. No settlement has yet been undertaken in the Unclassed Forests, the Deputy Commissioner considering that this large area is required for shifting cultivation on a three-year rotation. The policy adopted in Burma for the Karens might be applicable in this case (*vide p. 60 ante*). *U.P.*—The rights are all settled in the Province for Working Plan purposes. As regards privileges, the burden of grazing is considered too

heavy. A settlement of the Kumaun Forests was commenced in 1911 and completed in 1915, the greater portion of the forests being placed under the Department. Owing to the non-cooperative movement a considerable area of these forests was burnt in 1921, and Government ordered a revision of the settlement under which certain areas were withdrawn from the control of the Department. *Punjab*—All the Reserves were settled and 3,996 square miles of the Protected Forests. *Burma*—The Chief Conservator states that there is a considerable lack of definition between rights and privileges, except in the case of *taungya* cultivation, which is defined by the Act as a privilege subject to control, restriction, etc., without compensation. This definition has been in force since 1902. In the case of many of the old Reserves the rights are far too indefinite. *Bihar and Orissa*—Most of the Reserves are free of rights. All Protected Forests are subject to heavy rights, the regulation of which to those entitled to them is very difficult to enforce in practice. *Assam*—The rights are defined in the Reserved Forests. *C.P. and Berar*—Technically no rights exist in the forests. Concessions and privileges are granted at the pleasure of Government. Practically, the grazing question is a very serious problem except in S. Raipur, where it has been settled under the new Working Plan, and in Nagpur Wardha, Yeotmal, Nimar and Melghat, where grazing settlements have been framed. *Madras*—During the settlement of Reserves rights and privileges are settled once for all. The Chief Conservator states that these have been settled over an area of 18,956 square miles. *Bombay*—Settlement work is on the whole complete. 14,970 square miles of Reserved and Protected Forest have been settled and all rights recorded. Forest Settlement Officers can only make recommendations as regards privileges. Owing to the non-cooperative movement some revisions were made to extend the area of Minor Forests in the Kanara Divisions, and the Coast Minor Division was created in 1924. A Revision Settlement Report of the valuable Thana *Gurcharans* was under the consideration of Government, and a revision of the protected Forests of Peint was to be undertaken.

Under *Demarcation* work, the total length of boundaries in 1922-3 was 170,547 miles, of which 149,809 were artificially marked by masonry or loose stone pillars, mounds, or posts of various kinds, or by lines. The lengths in the chief Provinces were as follows : Bengal, 3060 miles (1835 artificially

demarcated); U.P., 14,485 miles (11,855 artificially demarcated); Punjab, 9842 miles (8569 artificially demarcated); Burma, 20,182 miles (16,768 artificially demarcated); Bihar and Orissa, 5017 miles (4647 artificially demarcated); Assam, 4563 miles (2477 artificially demarcated); C.P., 34,217 miles (30,725 artificially demarcated); Madras, 33,981 miles (31,188 artificially demarcated); Bombay, 42,681 miles (39,761 artificially demarcated).

During the period considerable progress had been made with *Forest Surveys*. By 1922-3 a total area of 91,814 square miles of forest had been under "detail survey" as follows: Bengal, 3265 square miles; U.P., 7102 square miles; Punjab, 4365 square miles; Burma, 18,970 square miles; Bihar and Orissa, 1805 square miles; Assam, 4807 square miles; C.P., 19,514 square miles; Coorg, 478 square miles; N.W.F. Province, 445 square miles; Ajmere, 144 square miles; Baluchistan, 227 square miles; Andamans, 527 square miles; Madras, 17,182 square miles; Bombay, 12,983 square miles. Forest Surveys now form a branch of the Survey of India. The maps prepared are on the one, two and four inches to the mile. An interesting departure in connection with surveys was the aerial survey work undertaken in Burma. The first of these surveys was for the Irrawaddy Delta Forests (1000 square miles) carried out in 1924, and the second, a more difficult undertaking, for some 15,000 square miles of unexplored forest in mountainous country in South Tenasserim. The work was remarkably successful, and will be described in a later chapter.

It will be evident that the expansion of the Staff has been very considerable during the period under review when compared with the previous thirty years. And with this expansion of Staff, combined with progressive scientific management, the revenue has increased from Rs.1,97,70,000 in 1900-1 to Rs.5,67,44,683 in 1924-5, and the surplus from Rs.86,10,000 in 1900-1 to Rs.2,13,12,705 in 1924-5, the latter figure exceeding one million and a half pounds sterling. It may be stated with some confidence, however, that the future will witness progress on a greater scale, provided a high level of efficiency is maintained and that the Department is assisted by liberal grants of funds, and the recognition of the great importance and value of its activities to the general well-being of the country. As a result of the Reforms of 1919 the position is not, however, free from anxiety, since it has become apparent that the Department and its work are

regarded with suspicion, if not with distrust, by many Members of the Legislative Assembly and the Legislative Councils. It may be suggested that the education of the Councils in the Provinces is a primary duty of a Chief Conservator, and should be accounted, in the interests of forest policy in the country, as important as touring. For this cause alone the Chief Conservator should be a Member of the Legislative Assembly. The value of the work done in this capacity by the Chief Conservators in the United Provinces and Punjab, notably Mr. H. G. Billson under difficult conditions in the former, is incalculable. The position of the Department in crucial matters of policy is probably more difficult at the present time than has been the case since the early years after its inauguration. With this realization it is difficult to ascribe a serious value to the argument that the post of Inspector-General of Forests or Expert Adviser to the Central Government is no longer required.

Before briefly reviewing the work of the Inspectors-General, the changes which have occurred in the constitution and working of the office during the period under review will be mentioned. Up to the year 1923 the Inspector-General of Forests and the Assistant Inspector-General of Forests were, as hitherto, attached to the Government of India Secretariat under the Department of Revenue and Agriculture, and their salaries, etc., were provided for in the departmental budget under the head "Forests." The office provided for carrying on the work on the Secretariat side was staffed by regular members of the Department of Revenue and Agriculture, their salaries, etc., also being met from the Forest head. The Inspector-General of Forests had power to deal entirely with and pass final orders on many of the communications received in the Department, but all important matters were passed on to the Secretary of the Department, and when necessary to the Honourable Member in charge for final opinion. In addition to this work the Inspector-General of Forests also had to deal direct with communications from Local Governments and Administrations, Chief Conservators, Conservators, etc., in which his personal opinion was sought, and with all enquiries relating to the Forest Research Institute and College on the Research and Educational sides, which were submitted to him from the President of the Institute. This work was also dealt with by the Forest Branch of the Secretariat, and if necessary was submitted by the Inspector-General of Forests

to the Secretary and Honourable Member of the Department of Revenue and Agriculture in the same manner as the departmental cases. Early in 1923, as a result of the recommendations of the Inchcape Committee, the Department of Revenue and Agriculture was absorbed into the Department of Education, the amalgamated Department being renamed the "Department of Education, Health and Lands." The appointments of the Inspector-General of Forests and Assistant Inspector-General of Forests, together with the Forest Branch of the Revenue and Agriculture Department, were transferred to the new Department, the expenditure connected with the salaries of the two officers and staff being debited, as hitherto, to the Forest head. Since the change in departmental control came about further retrenchment has been effected by holding the post of Assistant Inspector-General of Forests in abeyance. This proposal was given effect to when the last incumbent of the post vacated it in October, 1923, a move that has necessitated a change in procedure in dealing with the work at headquarters. When the Inspector-General of Forests is on tour all cases, which do not require his personal views, or on which he has previously recorded an opinion, pass through the hands of the Under-Secretary in the Education, Health and Lands Department to the Secretary and Honourable Member of the Department if necessary, but matters of importance are generally sent to the Inspector-General of Forests in camp or his views obtained by telegram.

This post of Inspector-General of Forests has now been in existence for sixty years, and it has been held by a sequence of distinguished Foresters and able administrators—Brandis, Schlich, Ribbentrop, Hill, Wroughton, Eardley Wilmot, Beadon Bryant, Hart and the present incumbent, Clutterbuck. Almost, if not quite, without exception each has stamped his individuality in the annals of the Department, and has left behind him administrative acts and ideas which have resulted in a marked advance. And throughout this long period the Government have had at their elbow an expert adviser who, perhaps almost unconsciously to themselves throughout the years, has given them advice in critical times on expert subjects which has resulted in guiding forest policy into the correct channels and thus assuring to the country the results so far achieved.

A brief review of the main features of the activities of the Inspectors-General may be attempted. Of the work of Brandis,

Schlich and Ribbentrop this history has already given full details.

H. C. Hill had officiated as Inspector-General of Forests before he succeeded Ribbentrop in 1900, and had already a reputation as a sound administrator and able financier by his work in Upper Burma. His sudden death towards the close of 1902 cut short his tenure of the post before he had time to leave a definite mark as Inspector-General. Hill wrote the following Inspection Notes on the Forests before and during his term of office: On the Central Provinces (April, 1894); Assam (March, 1896); Bombay (July, 1901); Coorg and Mysore (1901); and the Central Provinces (April, 1902), his last Report. Wroughton was appointed to officiate for Hill in April, 1902, when the latter went home on leave. Wroughton was confirmed on Hill's death, but took furlough preparatory to retirement, and Eardley Wilmot was appointed in March, 1903. During Eardley Wilmot's tenure of the post two developments were inaugurated which were to result in a greater advance in the Department. The first was the inauguration of the Research Institute at Dehra Dun in 1906. It is difficult even in 1925 to estimate the full effect of this step upon the future of the Department and of the Forest Estate in India. The Research Institute and Research generally are described in a subsequent chapter, and the results accruing from the coming of research will crop up throughout the rest of this history. It may be stated that the Department was ripe for the step by reason of its *personnel* and the work and observations of previous Forest Officers, amongst whom Eardley Wilmot himself should be included. But it is equally true that the step might have been taken nearly a decade sooner. There were men in the Department who would have been able to take full advantage of it had they been accorded the chance. The second event in Eardley Wilmot's tenure was the reorganization which he carried through at the expense of an immense amount of labour on his part and on that of his Assistant Inspectors-General—a reorganization of the Department which was long overdue. This work is reflected in the increase in the expenditure on the Department for a few years, an increase which was quickly followed by an enhanced revenue. Eardley Wilmot wrote the following Inspection Notes based on visits to the forests in the several Provinces whilst Inspector-General: Andamans (December, 1902); Bengal (December, 1903, 7th January, 1904, and 19th January, 1904); Bashahr,

Punjab (November, 1904); Central Provinces (February, 1905); United Provinces (March, 1905); Jammu and Kashmir (November, 1905); Kulu Forest Division (November, 1906); Kamrup and Garo Hills and Goalpara Forest Division, Assam (1906); Central Provinces (1906-7); Bashahr Forest Division, Punjab (1907); Madras Presidency (1907-8); and Bombay (March, 1909). The progress in silviculture in the United Provinces, which had been centred chiefly in Oudh, was largely due to Eardley Wilmot's efforts, and he effected a good deal to awake interest in other Provinces. In matters of pay and emoluments he greatly improved the status of the Department, and as has been shown, he did much to improve education and establish research. All these matters were overdue, and by his efforts he provided the remedies which placed the Department on a sounder basis. Eardley Wilmot retired in 1908, and was followed by Beadon Bryant. Several interesting and able Inspection Reports are to the latter's credit, the best perhaps being the Report he wrote on the financial position of the Madras Forest Department as the result of an invitation from that Government to visit the Presidency. Beadon Bryant's tabular statements contrasting the financial position of the various Provinces under different heads of yield, revenue and expenditure are both interesting and illuminating, and form a valuable exposition of the position of the Forest Departments in various parts of India at the time. It was during these years that the decision was taken with the assistance of Sir Robert Carlisle, Revenue Member, to build the Research Institute building on the Chandbagh site at a total outlay of Rs.5,08,000 and thus house the officers of the Institute according to the estimated needs of that time—estimates which were to be falsified in so brief a period. Beadon Bryant wrote the following Inspection Notes based on visits to the Provinces concerned: Kheri Division U.P. (March, 1909); Narsingpur and Hoshangabad, Central Provinces (March, 1909); Andamans, April, 1910; Sundarbans and Singbhum, Bengal (January, 1910); E. and W. Circles, United Provinces (April, 1911); Coorg (February, 1912); Assam (April, 1912); Kashmir (November, 1912); South Chanda Division Central Provinces (with general remarks) (January, 1913); Note on Forest Revenue and Expenditure in Madras (February, 1913); the Hoshiarpur Siwaliks (March, 1913). Two matters of importance remained outstanding at the time of Eardley Wilmot's departure. (1) The relation of the

Department to the Civil Authorities in Bombay and Madras. (2) The effects of continued fire protection on teak and sál forests in the moister regions. Eardley Wilmot's visit to Bombay on his retiral paved the way to the removal of the chief obstacles in connection with (1). The small patches of scrub and other forest in the midst of cultivation were placed in the hands of the Revenue Authorities, and the Department was enabled to exercise its correct functions in the forest estate proper. In Madras the same difficulties obtained in many of the districts, while the relations between the Civil and Forest Authorities had become very difficult. The Board of Revenue still exercised control over all administrative and even professional matters. As a result of Beadon Bryant's representations Madras Forest Officers were placed on the same footing as their confrères in other Provinces. Under (2) he was instrumental in having Working Plans altered in Burma to permit of the relaxation of fire protection measures in certain localities. Hart succeeded Beadon Bryant in 1913, and held the post throughout the trying War years. The construction of a far larger Institute Research Building was sanctioned, with the active help of Sir Claude Hill, during Hart's regime. He will, however, be best remembered owing to the fact that a real renaissance in sylvicultural practice took place during his time—a renaissance which applied practical sylviculture to the preparation of the Working Plan. Hart himself was a sound sylviculturist. His numerous Inspection Notes portray this unerringly. During his visits to the Bombay Presidency he put his finger upon the extraordinary weakness displayed in the Working Plans of the Presidency. He accepted the belief held by many at the period that coppice with standards was an antidote for the poor condition of large areas of forests in the Presidency, in the Central Provinces and elsewhere, a fallacy now only too apparent. But this does not detract from the real lasting effect of his Inspection Reports, backed as they were by the increasing strength of the Research Institute and the sylvicultural work being carried out by Mr. (now Professor) Troup, who acted as Hart's Assistant Inspector-General for a time, and others. Hart made his mark in the Department in spite of the fact that the Great War was being waged during his time, and that from the end of 1916 onwards as the Forest Representative on the Munitions Board he was responsible for the great activities of the Department in supplying that Board with produce of many kinds from many Provinces of India.

The Department came out of that ordeal in a notable manner, thanks to the great ability displayed by the senior men, who were debarred from serving with the fighting forces, and to the remarkable energy and work of many of the Indian subordinate staff. Hart wrote a number of Inspection Notes during the period he held the post: The Chakrata Forest Division, U.P. (July, 1913); Rawalpindi and Lahore Divisions (November, 1913); Andamans (December, 1913); Burma (March, 1914); Assam (March, 1915); Buxa and Jalpaiguri Divisions, Bengal (March, 1915); further Note on same with Gaolpara Sâl Forests (April, 1915); Kulu and Kangra (December, 1915); Bashahr Working Plan (December, 1915); Coorg (February, 1916); E. Circle, United Provinces (April, 1916); Sundarbans, Bengal (August, 1916); Chamba (October, 1916); Kumaon Forest Circle (November, 1916); Darjiling and Kurseong Hill Forests, Bengal (December, 1916); Bombay Presidency (April, 1917); Bashahr (November, 1917); Bombay and Sind (December, 1917); Burma (March, 1918); Kulu and Kangra, Punjab (October, 1918); Coorg (January, 1919); Madras Presidency (January, 1919); Andamans (March, 1919); So. Raipur, Central Provinces (February, 1921); Bengal Northern Divisions and Goalpara (June, 1920); Jubal State, Punjab (October, 1920); Kashmir (December, 1920); Andamans (February, 1921). Hart retired in 1921, and was succeeded by Clutterbuck, the present Inspector-General. For reasons which will become evident, Clutterbuck has not toured as much as his predecessors. He wrote an Inspection Note—The Lower Hazara Division N.W.F.P. (November, 1922). It is during Clutterbuck's time that the crisis or succession of crises with reference to the post of Inspector-General have come to a head, which it is proposed to deal with briefly. It may be asked—Would the Department have attained the highly organized position in which the War found it, and would the remarkable work which it has carried out, and the extraordinary progress which has been made since the Armistice, have been achieved had not the Government of India had through a period of sixty years an Expert Adviser at their elbow, an expert with a wide knowledge and experience upon whom Local Governments could also call for advice and whom the Presidencies appealed to when they were in difficulties?

And yet for some years past it has been an open secret that some Members of the Government, of past Governments, have

held the idea, or have toyed with the dangerous belief, that the post of Inspector-General of Forests was no longer necessary. That the work of reserving the forests, of creating a forest administration, was achieved, and that the appointment could be dispensed with. Quite recently under the retrenchment axe, which has been pursuing its course round the world, at times in the hands of a most unskilled performer, definite recommendations have been made on this subject.

The recommendations of the Inchcape Retrenchment Committee, so far as they refer to forestry, appear to be singularly misguided, and to anyone having cognizance of the real facts it seems obvious that the Committee included no representative possessing a knowledge of the part played by Forestry in India, either in the past or at the present day. The evidence placed before them, from many accounts, might have been more carefully prepared, but the average person hardly expects to find an Expert Committee appointed expressly to examine into the expenditure of the Administration writing: "We have found it impossible to obtain any satisfactory information in regard either to the working or to the financial results of the forest operations. No reliable information is apparently available as to the quality or values of timber produced and sold, or the stock on hand. There are wide differences between the estimates of the Forest Department and the budget estimates of revenue and expenditure even in the case of the revised estimates for the current year. In these circumstances it is obviously impossible for us to make any detailed examination of the expenditure, and we confine our observations mainly to the steps which we consider should be taken to place the Department on a proper footing." The Government of India Reviews and the Provincial Annual Forest Administration Reports would have enlightened them, as this history demonstrates. The Committee speak of the "Department" which the average forester would take to mean the whole service administration. But this is not the case. All the Committee concerned themselves with, so far as their Report shows, is the Headquarters administration of the Government of India. One reason, it can hardly be accounted a palliation, for this most misleading step is the following: Before 1911 the Forest Department was administered and controlled by the Government of India who shared with the Provincial Governments the revenues from the forests and exercised strict supervision over their management. A change

was brought about in 1911 when Sir Guy Fleetwood Wilson introduced his scheme for the provincialization of the forests. With effect from the 1st April, 1911, alterations in the terms of the then existing provincial settlements with the various Local Governments were introduced. The chief object of these alterations was to convert a portion of the large fixed assignments, which most of the Provinces then received from Imperial revenues, into an additional share of growing revenue. Under this arrangement forest revenue and expenditure, as well as refunds, were made wholly provincial. The permanent provincial settlements applied to Madras, Bombay, Bengal, United Provinces, Punjab, Burma, Eastern Bengal and Assam (now Assam and Bihar and Orissa) and the Central Provinces. The letters to the various Local Governments from the Finance Department, Government of India (Nos. 4118 F. to 4125 F., dated 8th July, 1911), detailing the change commenced as follows: "I am directed to refer to the correspondence ending with Sir William Meyer's letter, No. 128, dated 29th March, 1910, conveying the views of the Local Government on certain recommendations made by the Royal Commission on Decentralization in regard to the various financial matters dealt with in paragraphs 52-118, Chapter III, of their Report, and to say that, after careful consideration of these views and with the approval of the Secretary of State, it has been decided to make certain alterations in the terms of the existing provincial settlements with the various Local Governments. The chief objects of these alterations is to convert a portion of the large fixed assignments which most of the Provinces now receive from Imperial Revenues into an additional share of growing revenue. One of the changes made to attain this object has been to treat as wholly provincial forest revenue and expenditure including the corresponding refunds. . . ."

It is at least open to serious doubt whether the inclusion of forest revenues in the new policy was a wise step since in the case of forests the control of finance is an important factor, and there are certain points in connection with a forest policy for a country as a whole which should remain in the hands of the Central Authority. So far as the Inchcape Committee are concerned their "Forest Department," shorn of the whole of the Provinces, merely consisted of Headquarter charges, Forest Survey, Research Institute, the North-West Frontier Province, Coorg, Andamans, other minor administrations and the expenditure incurred in England. The total expenditure

under these heads had risen from Rs.11,42,000 in 1913-14 to Rs.46,63,000 in 1921-2; Rs.52,45,000 in 1922-3 and Rs.44,99,640 in 1923-4. The Report says: "So far as we can ascertain the Forest Department has earned a high reputation for the management and development of the forests on technical lines, but we consider it essential that the forests should be managed on commercial lines and that a radical change in methods of administration should be effected forthwith." On the subject of the Forest Research Institute, which has been one of the main factors in the great progress made in forestry in India during the past decade and incidentally of the big increase in expenditure referable to the Government of India, the Committee write: "The activities of the Institute are twofold firstly, research, and, secondly, the training of recruits for the forest services in India. We are informed that, on the educational side, the Institute is very largely self-supporting and in any case the development of this side of the activities of the Institute is, in our opinion, desirable. As regards research, a very costly scheme has been elaborated, the expenditure involved under the building programme alone amounting to no less than Rs.1½ crores. It has been brought to our notice that the extended activities proposed for the Institute include certain investigations which would be more appropriately left to private enterprise, and we consider that in any case it is not justifiable, in the present financial situation, to incur expenditure from public funds on research on this scale. We recommend that the whole scheme for the expansion of the Institute be reconsidered and that no further expenditure thereon be incurred beyond such amount as is obligatory in view of existing commitments. The establishment proposed for the Institute should also be reviewed, and we recommend that for the next three years it be limited to Rs.8 lakhs, saving Rs.86,000." Fortunately, as a result of visits of high officials and Members of the Legislative Assembly to the Institute at Dehra, these short-sighted recommendations were not given effect to. But further development was stopped by a block grant being made for the ensuing three years. In 1925 I had the opportunity of discussing the Research Institute with Sir Clement Hindley, Chairman of the Railway Board. In the past matters have often been strained between the Railway and the Forest Departments, as has become evident in the course of this history. The following is Sir Clement's opinion on the economic side of the Research

Institute (15th September, 1925) which he very kindly recorded for me at my request: "The Forest Research Institute at Dehra Dun has already rendered services of supreme importance to the Railways of India, but there is still a vast field of work to be covered, and there is in fact, in the nature of the work, no possibility of its ever being finished and completed. We are, perhaps, only at the beginning of the methodical and systematic work which is continuously necessary if the Railways are to secure the best available material at prices which can be regarded as commercially profitable. This is one of the problems which a commercial concern like a railway has ever before it, but it is a problem which has become accentuated by the rise of costs in all directions and the consequent need for economy. It is also a problem which, like others relating to economical working, has become more prominent by reason of the recent separation of railway finances from the general finances of the country, whereby the onus of producing an adequate return on invested capital has been laid on the Railway Board.

"The Railways require an organization which will conduct investigations on scientific principles into the physical characteristics of available timbers and into the sources of supply. These investigations must be done by standardized methods and essentially co-related with the class of work required for the materials. The results of such investigations must be put at the disposal of every enquirer and every purchasing officer, and in a form which is capable of appreciation by those who are to some extent in ignorance of the scientific side of the subject. Ignorance of the sources of supply of available and suitable timbers, ignorance of the physical characteristics of available species, and perhaps ignorance of the need for research, has been the direct cause of unnecessary recurring costs and the extension of the use of artificial and expensive substitutes. With an abundant supply of timber of innumerable species all round us we have hitherto confined ourselves practically to the use of teak, deodar and sâl, with the result that scarcity and high prices have confronted us on many occasions. With the Research Institute working for us and giving us scientific results of real commercial value, we can look forward to an extension of the use of timber and an enlargement of the species made available for railway work. Possibly the most valuable work of the Institute is the investigation of physical properties of species, but it is difficult to

estimate the value in the future of the work on preservation and seasoning which the Institute also undertakes. Already one railway creosoting plant depends on the Institute for scientific guidance in its operations. Without the experimental work which is possible at the Institute the use of the plant would be strictly limited and there would be the greatest difficulty in overcoming some of its problems. In the direction of seasoning and other preservative treatment the Institute with its equipment is also performing notable practicable services. The particular question of artificial seasoning, with its possibilities of reducing costs by restricting the size of stacks of timber held for coach-building, etc., is one in which the railways rely for help. In the event of artificial seasoning becoming usual on railways it will mean a further reliance on the continuous experimental work at the Institute. It is hardly too much to say that the potential value of the Institute to the railways is so great that if it were not in existence those responsible for the administration of the railways on commercial lines would have to create some such organization to 'take care of' the scientific side of timber treatment and use."

Having so signally failed to appreciate the value of the expenditure on the Research Institute the Committee could scarcely, perhaps, be expected to understand the methods of administration of the Department and the importance of having an expert in the person of the Inspector-General of Forests at the Headquarters of the Central Administration. Their recommendation, "that the control of the Forest Department should be vested in a Manager with commercial experience in the timber industry assisted by the necessary technical experts," amounts to a confession of ignorance; they may be nearer a much-to-be-desired object in recommending "that the accounts of the Department be placed on a commercial basis," if this hope is not Utopian in any Government Department. Other arguments against the retention of the post of Inspector-General of Forests are the presence of Chief Conservators in most provinces, the possibility that the forests will become a "transferred" Department in all Provinces, and that the Government of India will, in consequence, have less and less to do with forest management and forest policy. The presence of Chief Conservators in the Provinces can have little bearing on the duties of an Inspector-General with the Central Government. At the most a Chief Conservator will not usually have experience of more than two

Provinces of India and cannot therefore have the wide administrative outlook of an Inspector-General. Under the Reforms the Forests were not necessarily made a "transferred" subject. In Bombay and Burma the Forest Departments were subsequently transferred and consequently came under an Indian Provincial Minister. The question of the wisdom of such a step will be considered later. But in the event of the other Provinces following this lead it would seem to render the necessity of retaining the Inspector-Generalship all the greater. It is argued that the Central Government would in such a case have little to do with the forests and their management. But is this a possibility in a country where the forests are of so great an importance to the welfare of the community, quite apart from their commercial value, as in India? Could the Central Government ever contemplate disassociating itself from the control of general forest policy? The history of most of the forest countries of the world furnishes evidence that where a forest policy common to the country as a whole has been absent sooner or later waste and bad management have inevitably supervened, terminated at length by the Central Authority taking charge. Under the new regime in India decentralization in forestry matters at so early a stage in the new form of Government would at the least imperil the fine work of sixty years and might well spell disaster. If the history of the past is any criterion to the future it appears reasonably certain that the Central Authority could not control a modern forest policy in these rapidly moving times without an expert adviser of wide experience to call upon. The mere fact that Forest Revenues are now provincial is a strong reason why the Government of India should one way or another control and so co-ordinate forest policy throughout the country. It is only a Central Authority who can settle the broad lines of policy amongst which may be mentioned, as examples, the importance of the forests to Agriculture—the safeguarding, for irrigation or power schemes, the levels of the great rivers whose catchment areas may be hundreds of miles distant (in another Province) from the points at which the water is being utilized. With the forest budgets, upon which the protection and progress of the forests depend, now in the hands of the Councils there are strong arguments in favour of the Government of India retaining such control as will enable them to prevent reckless or ignorant waste through excessive grazing, etc., or trenching upon forest capital by a

Province who is in need of money. This check can be best maintained through the Working Plan. Here, again, the history of the past fifteen years is disquieting. In previous parts it has been recorded that the decentralization introduced at first into the Department (II, pp. 491, 595-9) resulted in the Inspector-General being ignorant of the progress made in Working Plans and also of the departures made without authority from the prescriptions by Conservators and Divisional Officers. Schlich placed the Working Plan in its correct position and secured the Government of India's sanction to the position the Inspector-General was to occupy, both as regards advice and supervision on this important professional work. The step taken by Schlich marked an epoch and has been justified by the progress evident in Working Plans at the present day. With the exception of Madras and Bombay, in which Presidencies the Inspector-General had no jurisdiction and only gave advice when invited to do so, for well over thirty years the proposals for new Working Plans were seen by the Inspector-General and discussed with the individual Conservator and Local Government concerned. The plans were finally sanctioned under his advice, and the Annual Control Forms came to his office, where they were checked by the Assistant Inspector-General of Forests and explanations called for in the cases where prescriptions had been departed from without previous sanction having been obtained. In effect the Inspector-General was responsible for the correct drafting and for the carrying out of the prescriptions of all the Working Plans in the Provinces under the Government of India. With the exception of the Central Provinces and Assam, which are both backward in this respect, the latter especially so, all the Provinces show a better Working Plan record than the two Presidencies. As Working Plans developed in number and complexity the work of the Inspector-General and his office became increasingly heavy. With the appointment of a Chief Conservator in Burma it was proposed that the checking of prescriptions in sanctioned Working Plans should be left to him. In 1906 the work of checking control forms was made over to the Superintendent of Working Plans at the newly formed Research Institute, that officer reporting on deviations to the Inspector-General. The Royal Commission upon Decentralization in India (1909-10) made recommendations on the subject of Working Plans, of which the following is an extract (p. III, pars. 302-3): "302. As regards Working Plans, the present

position outside Madras and Bombay is as follows : When a Working Plan is to be prepared, the Conservator concerned submits a preliminary Report to the Inspector-General, who communicates his remarks thereon ; and the Conservator is expected to consult the Inspector-General on all important technical points connected with the elaboration of the Plan. The Inspector-General may issue direct instructions to the Conservator regarding such technical points : otherwise he addresses the Local Government with a view to the issue of such orders as may appear advisable. When a Working Plan has been drawn up, the Conservator submits it to the Inspector-General, who forwards it, with his opinion and remarks, to the Local Government for orders. To provide that the prescriptions of a Working Plan are adhered to, Conservators submit abstracts of their ' control books ' to the Inspector-General, who, if he notices any deviations from the orders sanctioning the Working Plan, draws the attention of the Conservator to this fact for explanation, or in order that the Local Government's orders may be obtained. The Inspector-General is assisted in dealing with Working Plans by one of the professors in the Forest College at Dehra Dun. In Madras and Bombay, the Inspector-General of Forests receives copies of Working Plans for information, but is not consulted thereon unless the Local Government specially desires to obtain his advice. The Chief Conservator of Forests in Burma considered that that Province might now deal finally with its own Working Plans, and the Conservator in Bengal complained of the subordination of Conservators to the Inspector-General which the present system involved, and held that the functions of the latter officer should be advisory only. A Conservator of Forests in the Central Provinces, on the other hand, was in favour of maintaining the existing arrangements, while the Inspector-General desired that the system in other Provinces should be applied to Madras and Bombay also. Having regard to the large number of Working Plans which are not of first-class importance, and to the present high training and large experience of the superior Forest Officers in the Provinces, we do not think it necessary that the Inspector-General should be called in as an adviser over every Working Plan. It is desirable that he should be consulted in the case of Plans relating to specially large forests, but otherwise these should only be referred to him when the Local Government thinks his advice would be advantageous. Sir S. Edgerley dissents from this clause. In

his opinion 'largeness' is not the proper measure of need for outside advice. He would leave the reference to the discretion of the Local Government in all cases. All Working Plans should, however, continue to be communicated to him for information, and this will give him the opportunity of offering remarks to the Local Governments, when he thinks this desirable, in cases where he has not been specially consulted. We think that the submission of control forms to the Inspector-General is superfluous."

The Government of India had been considering the position of Working Plans previous to the appearance of the Commissions' Report and certain proposals had been formulated. It was recognized that the recommendation above detailed reopened the question, although certain of the suggestions, such as the remark that the Inspector-General "should be consulted in the case of Plans relating to specially large forests," were vague and valueless where Working Plans were in consideration. The Government of India therefore issued a Circular (No. 16 F.—160—1, dated 31st May, 1910) to all Local Governments except Madras and Bombay, asking for their opinions. It may be mentioned that Eardley Wilmot considered that the procedure in force should be applied to Madras and Bombay. The following extract from the Circular explains the position: "Working Plans regulate the treatment of Forest Estates for long periods, and an ill-considered Plan will certainly injure and may ruin the forest concerned. As the arrangements that Local Governments can make for checking Working Plans are not the same in all Provinces, it appears to the Government of India that there are objections to accepting the Royal Commission's proposals as uniformly applicable. It would appear to be desirable that all Working Plans should be subject to a double check, and that two experienced officers should examine them before they are submitted for sanction to a Local Government. Accordingly, the Government of India would suggest that in Provinces where there is a Chief Conservator the final scrutiny and check of Working Plans before submission to the Local Government might be left to that officer, and the Inspector-General of Forests need not be asked to advise unless the Local Government desires his opinion; but in Provinces where there is no Chief Conservator, a satisfactory double check cannot be exercised within the Province, and the Government of India are inclined to think that preliminary Reports and completed

Working Plans should be submitted to the Inspector-General of Forests direct and not, as now, through the Superintendent of Working Plans. In all cases copies of sanctioned Working Plans should, however, be forwarded to the Inspector-General of Forests for information, and this officer would always be at liberty to bring defects in Working Plans to the notice of the Local Government concerned. As regards the checking of control forms, the present rules are contained in this Department's Circular, No. 37 F.—344—14, dated 13th December, 1906, and provide that : (1) The Conservator or, in Provinces where there is a Chief Conservator, the Chief Conservator is responsible for the accurate compilation and checking of control forms. In Provinces where there is more than one Conservator, but no Chief Conservator, the Local Government may, if it so wishes, entrust the work of checking all the control forms of the Province to one of the Conservators. (2) Signed copies of the 'forms' should be forwarded on the prescribed date to the Inspector-General of Forests (care of the Superintendent of Working Plans) by the officer by whom the forms have been checked. The Inspector-General is at liberty to point out to the Local Government any departure from the sanctioned Plan which may come to his notice, but he does not subject the forms to detailed examination and the entire responsibility for securing accurate compliance with the prescriptions of the Working Plans rests with the Conservator or Chief Conservator who checks the forms."

"The information contained in control forms is not available in any other form, and as it is required by the Imperial Forest Research Institute in collecting statistics and in sylvicultural research generally, the submission of these forms to the Inspector-General of Forests or to the Superintendent of Working Plans is necessary. The Government of India are inclined to think that no change in the existing rules is necessary, and that the check of control forms may safely be left to Chief Conservators and Conservators."

All the Local Governments and Administrations accepted the proposals with the exception of the United Provinces and the Punjab, who, although they had no Chief Conservator, considered that they should be placed upon the same level as Provinces which had. To this the Government of India were unable to agree. The future procedure, as regards Working Plans, was laid down by the Government of India in their Circular No. 29 F.—160—14, dated 23rd September, 1910, the

procedure to come into force from the 1st January, 1911. "(1) In Provinces where there is a Chief Conservator of Forests, the final scrutiny and check of forest Working Plans before submission to the Local Government for sanction will be left to the Chief Conservator, and the Inspector-General of Forests will have no concern with the preparation of such plans unless the Local Government desires his opinion. (2) In Provinces where there is no Chief Conservator of Forests, the procedure as laid down in Sections 85 and 90 of the Forest Code will remain unchanged and preliminary Working Plan Reports and completed Working Plans will be submitted to the Inspector-General of Forests direct. Circular No. 17 F., dated 13th July, 1906, is hereby cancelled. (3) Copies of sanctioned Working Plans will in all cases be forwarded to the Inspector-General of Forests for information and record. (4) The Inspector-General of Forests will be at liberty to bring defects in Working Plans of all Provinces to the notice of the Local Government concerned. (5) The rules regarding the submission and checking of 'control forms,' laid down in this Department's Circular, No. 37 F.—344—14, dated the 13th December, 1906, will remain unchanged with the exception that signed copies of the forms will be forwarded on the prescribed date to the President, Imperial Forest Research Institute, Dehra Dun, instead of, as at present, to the Inspector-General of Forests (care of the Superintendent of Working Plans) by the officer by whom the forms have been checked. Under the arrangement prescribed in paragraph 1, (2) above, the examination of Working Plans from Provinces in which there is no Chief Conservator of Forests will in future take place in the office of the Inspector-General of Forests at Headquarters. The Imperial Sylviculturist will therefore no longer be Superintendent of Working Plans and he will cease to use the latter designation."

By 1921 the only Provinces without Chief Conservators were Bengal, Bihar and Orissa, and Assam. In Government of India letter (No. 1571 Forests, dated 19th October, 1920) to those three Governments the procedure laid down in 1910 in regard to the submission of preliminary and final Working Plan Reports to the Inspector-General was modified. The letter said: "All such Reports need not, in the ordinary course, be sent to the Inspector-General of Forests. He will always be glad to examine Working Plans for them if so desired, but reference to him in future will be optional."

In a précis drawn up on the past history of Working Plans in India (published in *Government of India Notes*, "Forests," A. June, 1910, No. 1) the following extract contains the crux of the present position. "The points for consideration, therefore, are whether the time has now arrived when the Central check exercised by the Inspector-General may be relaxed partially as the Commission propose, and whether it is desirable to do so in the present state of Forestry in India. The Government of India exercise control over the State Forests through the Inspector-General, who is at present responsible for the recommendation to Local Government of *suitable systems of management of the State Forests*. If this responsibility is not to be decreased it is evident that every plan should be seen by the Inspector-General before it is approved. The present system is advantageous both to the Local Government and to the Inspector-General, to the former specially because they will have the varied experience and wider knowledge of the Inspector-General at their disposal and to the latter because of his responsibility in the matter both to the Government of India and the Local Governments."

These sentences were written by a man who had the clear vision of the responsibility of the Government of India *vis-à-vis* the State Forests. Has that responsibility been any whit lessened by the introduction of the Reforms? Is it not a heavier burden and a far greater responsibility in 1925 than was the case in 1910? Provincial pride on the part of Local Governments and their Forest Staffs is understandable, but to the latter there can be nothing derogatory in having a Chief at the headquarters of the Central Government who in times of difficulty and crises—and it is to be feared that many such will have to be faced till the Legislatures have become more informed on matters of national forest policy—can be summoned to give advice. That such is the present position is borne out by the fact, recounted to me by the Inspector-General himself, that almost as soon as the forests were made a "transferred" subject in Bombay that Government invited him down to advise on certain forest problems. But that is the other side of the question. The crucial point is, can the Central Government maintain an efficient control over forest policy without the expert advice of an Inspector-General at hand?

It is difficult to envisage a position so radically changed, even through the appointment of Chief Conservators and the

changes in administration brought about by the Reforms, as to demand so serious a *volte face* from the views expressed by the Government of India in the *Quinquennial Review of Forest Administration* (21st July, 1915) for 1909-14. The following expression of opinion appears on page 2: "During the period under review the tours of the Inspector-General extended over portions of Bengal, Assam, the United Provinces, the Punjab, the Central Provinces, Burma, Madras, the Andamans, Coorg and Kashmir" (the latter an independent Indian State!) "These tours are of the greatest value, not only to the Government of India, but also to Local Governments and local officers, as they enable an independent opinion on professional matters to be obtained from an officer of wide experience and tried ability. Thus, to quote two instances only, the value of Mr. Beadon Bryant's Note on Forest Revenue and Expenditure in Madras has been warmly acknowledged by the Government of that Presidency, while Mr. Hart's Note on the Burma Forests deals with questions of vital importance and may have considerable influence on their future management."

Whilst in Simla (April-May, 1925) I had the advantage of discussing this and other matters with Mr. J. H. Bhore, C.I.E., C.B.E., I.C.S., the able Secretary, Department of Education, Health and Lands. The alternatives under consideration in connection with the post of Inspector-General of Forests were, I understood, firstly, that the post be abolished, secondly, the post be combined with the Presidentship of the Forest Research Institute and College. It was no secret that the matter had not been finally settled. Equally so that a decision had been pending for some time, as witness the extensions in the post granted to Sir Peter Clutterbuck, with the object presumably of keeping the post in being till all the aspects of the case had been considered. To some extent assistance may have been looked for from the Lee Commission, although this matter did not fall within the scope of their terms of reference. The Commission accepted the position as they found it. Sir Reginald Craddock, G.C.I.E., one of its principal members, did not entirely agree with the recommendations of the Commission in certain matters. In a Minute "Upon certain of the conclusions of the Commission" he wrote: "The Forests are still, except in Bombay and Burma, controlled by the reserved side of Government, and although we propose a higher ratio of Indianization than has hitherto been

adopted, the realization of this ratio must depend upon the readiness of Indians to qualify themselves for a Service which has hitherto not made any serious appeal either to the Indian student or to the Indian parent. The projected improvements in the Forest College at Dehra Dun may invoke a greater enthusiasm among Indians for a forest life than has yet been manifested. If so, well and good ; but it is to be hoped that no Government of India, whether it be of Members or of Ministers, will allow itself to underrate the enormous importance of the forest estate in India both to Indian agriculture and to Indian commerce. I have been closely associated with the two Provinces in India in which Reserved Forests cover the largest areas. The labours of past generations of Forest Officers have not been in vain, but the fruits of these labours are still not fully to hand. Organized research is still very much in its youth, and it would be a lamentable event if forests ever came to be regarded as a dependent in which inefficiency was of little consequence. The Provincial Forest Services have produced some excellent Forest Officers, many of them, it must be said, Anglo-Indians, and it is not lack of ability but lack of inclination for the isolation and exposure of a forest life that is most likely to militate against the more rapid Indianization of this great Service."

Speaking in a discussion on a paper entitled "Recent Progress in Indian Forestry" (*Jour. Roy. Soc. Arts*, No. 3812 Dec. 11th, 1925) by the author, Sir Reginald said : "It was, with much reluctance that he was a consenting party to the transfer of forests in Burma to the category of transferred subjects. The local issue was very important there at the time, and stressed very strongly, and he found, even among the senior officers of the Forest Department, that instead of opposing transfer there was a good deal of opinion in favour of it. He believed it was generally thought by them that it would be easy to work through a Minister, who would probably know nothing about the forests and would be glad to follow any advice given to him ! In being a consenting party to that transfer, he wished to safeguard himself and the Government of Burma very strongly by laying great stress on the fact that the constitution of India provided that at the end of the ten years' period there might be some retracing of steps as well as a further advance. Forests were of such extraordinary importance that if the ten years' experience proved that the experiment of transferring them to the control of the Ministers

had not been a success, or at least had been accompanied by a distinct loss or failure, the position might, at the end of that period, be very properly reconsidered."

Nor do all the Provinces regard with favour the effort to make the forests a "transferred" subject. In discussing the matter with a Governor of one of the important Provinces, who viewed such a policy with grave concern, he deplored the fact that the Lee Commission included no expert conversant with the theoretical and practical aspects of the Forestry question; of the real vital necessity of the forests to a country like India, and of a co-ordinated forest policy laid down and jealously guarded by the Central Government.

At Simla the opinion seemed to be held in some quarters that an Inspector-General was no longer required at Delhi and Simla, and that the double headquarters, combined with the considerable amount of touring essential for the holder of the post, was a hardship owing to the expense entailed. The actual headquarters in these days of motor-cars appears a small question. Dehra Dun would be as convenient as Simla and Delhi. The amalgamation of the post with the President of the Research Institute would seem, however, in some degree detrimental to efficiency since it would preclude the Inspector-General from touring as extensively as is desirable. When the Forest Research was first instituted, Eardley Wilmot, the Inspector-General, became the first President of the Institute. If the Inspector-General's headquarters were transferred to Dehra Dun and he became *ex officio* President of the Research Institute it may be suggested that a Vice-President should be appointed under him to have charge of all the Research and Educational work. Only larger administrative questions in connection with the Institute and College would be dealt with by the Inspector-General of Forests.* Further, it should be the aim of the Inspector-General to appoint to the post of Vice-President whenever possible a Forest Officer who has made some scientific reputation for himself, either from amongst the officers in charge of the Research branches or from the ranks of the Department. It has been one of the weaknesses, certainly in the opinion of European scientific circles, that since the inauguration of the Institute its President has been unknown

* In March, 1926, a Government of India notification announced that this policy had been given effect to. Mr. A. Rodger, O.B.E., was appointed to succeed Clutterbuck as I. G. Forests and President.—E.P.S.

to scientific circles, a weakness to the Institute and a drawback to the Department at large. It is true that during the first years the administrative work was considerable, but the scientific man with administrative ability is not unknown to the Department. Also it appears to have been a rather short-sighted policy to rule out the officers chosen for the Research posts, presumably picked men, from the possibility of ever becoming President of the Institute. This is one of those curious anomalies of official administration which has so depressing an effect on the keenness and predilection a good officer may have for scientific research. In any event, the comparative trifling cost of a couple of thousand rupees or so a month for the salary of a Vice-President would be recovered a hundredfold by maintaining the necessary co-ordination between the work of the Research branches and in tightening link by link the connection between the Central Institute and the Provincial Research Officers.

The fact that the Lee Commission's Report appeared to rather favour decentralization, or, at least, to accept the *fait accompli*, has been commented upon. Also the steps by which the Government of India have been gradually giving up their hold upon the forests and the maintenance of a forest policy. Since 1910 the Royal Commission on Decentralization, the Islington Committee, the Inchcape Retrenchment Committee, the Lee Commission, and lastly the Muddiman Committee of 1925 have all considered and made recommendations on the subject of the "Forests." Although the numerous Commissions and Committees took evidence from forestry officials not one of them included an expert member conversant with the details of forest management and of forest policy. Without exception, the recommendations of these bodies omit all reference to certain forestry principles which pertain to all countries, and especially to those with a semi-tropical climate. The Muddiman Committee went further even than the Lee Commission, the majority recommending that the Forest Department should be transferred to the control of Ministers in all Provinces, the idea being, apparently, that as forests are a transferred subject in Burma and Bombay the other Provinces should follow suit. Burma is so different from India, the population so homogeneous and the forests so obviously valuable to the country that the transfer in that Province has no application whatsoever to India. In Bombay the result of the step taken has yet to be seen. In discussing this

problem, the Southborough Committee considered that the transfer of the forests was undesirable in India generally, but that the experiment might be made in Bombay, and from experience gained there the future of forests in other Provinces might be considered.

In the consideration given to the above matters the writer has envisaged the position according to the light the many records consulted seemed to throw upon it. The problems have been widely discussed in the Indian Press. In the interests of historical development one quotation may be permitted. An interesting leader appeared in *The Pioneer* (March 20th, 1925) on this subject, of which the following extract merits quoting: "The very strong objections of the United Provinces Government to a removal of the forests from the control of the Governor in Council have found widespread publicity, and it is difficult to understand how the Muddiman Committee could have so lightly ignored an expression of opinion which definitely forecasts deterioration of forest administration to an extent that would not only endanger the forests themselves but also jeopardize the vital work of irrigation in the Province. It is notorious that the Punjab Government were at first in favour of the transfer of their forests. This, indeed, is admitted in the letter from the Government published with the report; but the Punjab Government have now arrived at the conclusion that the prejudice against spending money on the forests is so deep-seated that the experiment of transferring them would be fraught with risk not only to the financial position but to the maintenance of unclassified forests over which grazing rights exist. The Government of the Central Provinces are opposed to transfer, although they do not examine the question in detail. The Assam Government, while rejecting the idea that Ministers would not be capable of administering the Department, strongly oppose the transfer, because 'it is doubtful whether the majority of the Council appreciate the principles of forest policy, and the result of withdrawing the safeguards which exist so long as the subject is reserved might be disastrous.' In face of these unequivocal expressions of opinion on behalf of the Local Governments, it is indeed strange that the majority of the Muddiman Committee should have been able to bring themselves to support a transfer of the forests in all Provinces without presenting any stronger arguments than those which have been mentioned."

It is scarcely conceivable that for many years to come Provincial Legislatures will be in a position to appreciate the broad questions of practical forest policy which demand close co-ordination. Is such co-ordination possible, and can it be *maintained in continuity* by a number of different Legislatures each primarily concerned with their own part of the country? The answer can only be in the negative. The Madras Government have just embarked upon a policy of giving up some 4000 square miles of forest in the Presidency to the management of Panchayats or local village bodies. The grounds for this grave step are that these areas consist of scrub forest and grazing grounds, and it is a waste of money to leave highly trained Forest Officers in charge! This matter will be discussed in a later chapter. But what if a mistake has been made and these forests, the preservation of which is vital to the people, and has possibly been only maintained because they were under experienced management, disappear! Could a Central Government absolve itself from all responsibility in so grave an error in administration? The mistake has been made often enough in the past, as this history exemplifies (cf. Chap. I, *ante*).

The Transfer problem is connected with the suggested training of the probationers for the Imperial Service at the Institute and College at Dehra Dun. This matter is dealt with hereafter. I was asked to express my views on the subject whilst at Simla. In September, 1922, both the Legislative Assembly and the Council of State passed Resolutions recommending this step. At Simla I was informed that all Indian recruits for the Service would be trained at Dehra. The complication foreseen is that if the forests were transferred in all Provinces the Local Government would have the power, as already possessed by Burma and Bombay, to recruit for their upper Service from whatever source they pleased. Thus if the Government of India made provision for the training at Dehra Dun they might be left without any students—an unlikely contingency, but still a disconcerting factor which had to be taken into consideration. The change which the great Indianization of the Service and the training at Dehra would bring about would, it was considered, see the disappearance of the training courses for the Provincial Service, since the class of recruit coming forward for the Imperial and Provincial Service would be drawn from the same social status. In future the Provincial Service would be recruited by selected Rangers promoted into it, a desirable reversion.

Lastly, it appeared probable that the old Ranger Course could not be kept at Dehra if the latter was to be the centre of training for the senior officers. It is suggested that the Ranger's Class should be made over to the United Provinces Government and its headquarters be fixed at Bareilly or Clutterbuckganj. These matters are discussed in greater detail later on, but they form part of a co-ordinated whole which requires attention here in its entirety. A factor which presents itself in no uncertain light in connection with the consideration given to Forestry by the Commissions of the past decade and a half is that various important questions of policy have been dealt with in water-tight compartments and not first framed together as a whole before opinions and deductions were set down. Awkward positions arise, such as the training at Dehra decision conflicting with the possibility of having no one to train ! It may be suggested that it is desirable at this juncture that the Central Government should, after a careful consideration of *all the factors* coming into play, definitely announce a forest policy for the future in order that the Local Councils may know exactly how far their jurisdiction extends and where their authority over the forests ceases and that of the Central Government comes into action. It is owing to the vigilance and care of the Government of India and the Secretaries of State, commencing with that remarkable Secretary, Sir Charles Wood, in the infant days of forest conservancy that this magnificent forest estate has been brought to its present condition. My conversations at Simla led me to believe that the Government of India are not unmindful of their great responsibility.*

* *Note.*—In a letter dated 16 February, 1926, received from the Inspector-General of Forests, the following extracts refer to this and the following two chapters: (1) The full scheme for the new Research Institute, estimated to cost 111 lakhs of rupees, had been passed by the Standing Finance Committee. It still had to pass the Legislative Assembly. (2) The proposals to train Indian probationers for the I.F.S. at Dehra Dun, from November, 1926, had received the sanction of the Secretary of State. The expenditure involved had to pass the Legislative Assembly. (3) The existing Provincial Course would cease in March, 1928, when the students in training would complete their work. (4) The Ranger Course at Dehra Dun will continue to be given there and will remain under the Government of India.

CHAPTER XIII

ON THE TRAINING OF THE PROBATIONERS FOR THE INDIAN FOREST DEPARTMENT, 1901-25

A SOUND training in the Science of Forestry is essential to the efficient management of a great Forest Estate. It is proposed to review the considerable changes which have taken place in the methods of educating probationers for the Indian Forest Service, the Provincial Forest Service and the courses given to the lower subordinate staff.

I. THE INDIAN FOREST SERVICE

In treating of the training of the probationers for the Imperial Forest Service in previous Parts (II, pp. 42, 498), it has been shown that considerable differences of opinion had existed on the subject from time to time. The Government of India and the Secretary of State had not always seen eye to eye in this matter, and in fact had not been in agreement over the inauguration of the training under Schlich at Cooper's Hill, the Government of India expressing the desire to continue the education on the Continent.

In the capable hands of Schlich, however, the training at Cooper's Hill, based as it was on a previous public competitive examination, soon proved its value, and during the period for which it lasted many good officers entered the Service. With a knowledge of the work performed by many of these men, few would be inclined to dispute this contention. During the period no Government stipends were made to the selected probationers whose parents defrayed all the heavy expenditure the College entailed. An enquiry was conducted in 1900 by Sir Thisleton Dyer and Brandis with reference to remarks made by Sir George King on the want of knowledge of botany displayed by Forest Officers. The enquiry disposed of Sir George's aspersions, but Dyer and Brandis suggested that a better class of candidate might be secured if the forest probationers were transferred to Cambridge. Neither the Secretary

of State nor the Government of India considered the scheme to be practicable. Schlich and Colonel Ottley, President of Cooper's Hill, made other suggestions with the object of obtaining probationers with a considerable knowledge of the specialized science subjects, raising the age of entry to twenty-one and thus reducing the cost of the teaching staff at Cooper's Hill. This suggestion was not proceeded with. Instead, in 1890, the length of the probationer's training was raised from two to three years, the 1890 probationers only proceeding to India in the autumn of 1893. The reason for the additional year was due to the desire to provide a longer course for practical forest work on the Continent. From that date the probationers spent nine months in Germany, placed under German Forest Officers, who received fees from the India Office for their services. It is at least open to doubt whether this plan of subsidizing a number of German Forest Officers to do the work of the English Staff was, or is, a good one. Many educationalists hold that the Instructor who teaches the student, up to the stage at which the latter leaves to join his appointment, should also have the supervision of the practical part of the work up to this point under his own eye. In forestry training this is probably even more necessary than in other educational branches. The Professor and his staff know the individual probationers and their idiosyncrasies, and there is far less chance of the latter assimilating wrong impressions and ideas through failing to understand the methods of the new instruction. Moreover, to send students very imperfectly acquainted with a foreign language to undertake courses of the utmost importance to their future profession is, even in the case of a linguist, to lose time and opportunities whilst the latter is mastering the technical terms of the language, whilst in the majority of cases the probationer fails to really grasp the technique of the instruction. In the writer's opinion, practical work in continental forests is a waste of time, whether for the probationer or the officer home on leave, unless it is conducted under the personal supervision of British instructors who are in the habit of spending several months every year on the Continent.

The Forestry training at Cooper's Hill continued for twenty years, the college being closed down in 1905. The Government of India were averse from the closing of the College. The final decision of the Secretary of State was communicated to them in his Despatch No. 69 (Public), dated 22nd April, 1904. It had been proposed that the forest probationers should be

trained at a British University. The Government of India had suggested that in the event of Cooper's Hill being closed a reversion should be made to the old plan of training the men on the Continent. The Secretary of State was unable to agree (Despatch No. 134 (Public), dated 6th Oct., 1905). Schlich had the choice of transferring the training of the forest probationers to Oxford, Cambridge, or Edinburgh, the two latter being the Universities which had at the time the best facilities for education in science. In fact Edinburgh had enjoyed this reputation when Brandis proposed that the first selected probationers for the newly formed Forest Service should receive their training in Science at that University (II, p. 49). Moreover, Edinburgh at the time was the only University in the country which possessed a lectureship in Forestry. This had been established in 1887, the post being filled first by Professor Somerville (1887-9) and then by Lieut.-Col. F. Bailey, R.E., LL.D., who still held the post in 1905. It will be remembered that Col. Bailey was the first Director of the Forest School at Dehra Dun.

Schlich decided on Oxford, and the India Office made a grant to the University in aid of the new School. In 1907 Cambridge University inaugurated a Forestry School and appointed a Reader in Forestry, Mr. A. Henry.

It will be necessary to briefly recapitulate the history of the next few years. The Cooper's Hill Committee, which in 1903 reconsidered the closing of the College, advised as follows: "As there is no efficient teaching of Forestry in the United Kingdom it will be necessary for some years to come that the Government of India should continue to provide for the education of the selected candidates. The Professor of Forestry and one of his Assistants must be maintained as heretofore. The question then arises—where, in the absence of Cooper's Hill, are Forest Officers to be trained. Although the average number of Forest Officers required by the Government of India will be only eight annually, the Government of India is too deeply interested in the matter to allow of its being left to chance, or to the future establishment of schools for instruction in Forestry in accordance with the recommendation of the Departmental Committee on British Forestry, which reported to the Board of Agriculture last year. We think that it is possible, without much difficulty, to arrange for the transfer of the Professor of Forestry and even of his Assistant from Cooper's Hill to Cambridge or Oxford or

Edinburgh. At the last-named University there is already the foundation of a Forest School. . . . On the understanding that the pay of the Professor and his Assistant is provided by the Government of India, that Government should have a controlling voice in the choice of a Professor and in prescribing the course of instruction to be followed. Hereafter, when Schools of Forestry, with suitable staffs and sufficient equipment shall have been established with success, their degrees or diplomas may be accepted as proof of sufficient technical training, and the selection may be made from those who have acquired those degrees and diplomas, and are otherwise well qualified. When this condition has been reached, the Government of India need no longer concern themselves with the teaching staff or the course of instruction." As has been said, Schlich selected Oxford and the Secretary of State supported him. Candidates for probationership were to have passed Responsions on an equivalent examination and to pass a competitive examination in mechanics, physics, chemistry, zoology and botany. In 1905 only four candidates presented themselves for thirteen vacancies and only two passed the examination. The remaining vacancies were filled by selection. In the following year only two candidates offered themselves for nineteen vacancies and only one passed the examination. The other vacancies were again to be filled by selection. There were five other posts to be filled for the Colonies that year. Of the total number, twenty-three, thirteen were filled with difficulty. In 1907 and 1908 the competitive examination was waived and the age raised, the necessary qualifications being a good general education and, if possible, a knowledge of chemistry, mechanics and physics. In 1907 there were twenty-two vacancies for which sixty-three candidates appeared and twenty-one vacancies were filled, "but with some difficulty."

The annual payments made by the Secretary of State to support the Forestry Class at Oxford were as follows: Professor of Forestry, £900; Assistant Professor, £550; grants for teaching geology, forest garden, rents and taxes and miscellaneous, £395. Total, £1865.

This position of affairs was regarded as unsatisfactory, both by the Government of India and the Secretary of State, and the latter (Despatch No. 189, Public, dated 30th October, 1908) informed the former that he had appointed a Committee to enquire into the selection and training of probationers for the Forest Service, and that the Committee had presented their

Report. The Committee consisted of Mr. R. C. Munro Ferguson, M.P. (now Lord Novar), Chairman ; Sir John Edge, Sir W. Thisleton Dyer, Mr. E. Stafford Howard, Commissioner of Woods and Forests, and Mr. (now Sir Sainthill) Eardley Wilmot, Inspector-General of Forests. The Committee met in London in March-April, 1908, and took evidence from witnesses including Sir W. Schlich, the Vice-Chancellors of Oxford, Cambridge, Edinburgh and others.

With reference to the existing regime at Oxford they expressed the following opinion : " There is one defect in the system to which we wish to draw especial attention, namely, that it requires selected probationers who are still students of a University other than the University of Oxford to migrate to Oxford before the completion of their course ; and that it thereby throws a very real obstacle in the way of obtaining such students as competitors. From all points of view we consider that no scheme can be satisfactory which does not provide unrestricted access to the Service for all qualified candidates. . . . The advantages of a healthy competition between various Forestry Schools outweigh, in our minds, the benefits of a centralized training. Recognizing, therefore, the importance of encouraging Indian forestry education at other centres, and considering that giving a monopoly to any one centre must tend to discourage other centres from developing an adequate course, we recommend that a Professor with an Indian experience be provided for centres such, for example, as Cambridge and Edinburgh, as soon as the authorities of such centres have satisfied the Secretary of State in Council that a proper equipment for teaching forestry is provided at those Universities, and that their forestry courses will be open, as the Oxford course is at present, to any selected probationer." This latter recommendation was never given effect to by the India Office, but the Universities solved their own difficulties. One of the objects of the Government of India at this juncture was to shorten the course of training in England, greatly curtail the nine months prolonged practical course in Germany and substitute for it a practical forestry course to be given in India with Dehra Dun as the headquarters. This latter course to be conducted under the ægis of the Research Officers at the Dehra Institute, the home training to be confined to eighteen months. On his return to India Eardley Wilmot was requested to make preparatory arrangements for the Dehra Dun training, but the proposal was

eventually not given effect to as the bulk of professional forestry opinion in India was against it. The Committees' work had, however, not been without beneficial results, as the Universities had learnt the exact position of affairs.

Representations were made to the India Office by Cambridge and Edinburgh on the subject of the subsidy to Oxford, which was tantamount to subsidizing one University against others and incidentally closing the ranks of the Indian Forest Service to Oxford alone. A conference was called at the India Office in July, 1910, at which representatives of that Office and the three Universities were present. The writer had succeeded Col. Bailey at Edinburgh in the previous May. As an outcome of this conference the three Universities were accorded equal recognition as training centres for the supply of probationers for the Indian Forest Service. This recognition has continued up to the present time (1925). The training of the Indian Forest Probationers, therefore, had become the hall-mark stamping the centres receiving such recognition as fully qualified to teach Forestry, and the Applied Sciences which go with it, on the standard required by the India Office for their probationers. Edinburgh was also supplying probationers to the Colonial Office.

Under the regulations Schlich was due to retire from Government service in February, 1910. Lord Morley asked him to continue in his post at Oxford until new arrangements had been made, his tenure of the appointment to terminate with a six-months' notice on either side. In the following November Mr. W. R. Fisher, Assistant Professor at Oxford, died. The India Office had decided to appoint a Director of Indian Forest Studies and in their Despatch (Rev. No. 13, dated 13th February, 1911) informed the Government of India that they were giving Schlich the six months' notice terminating his service and asking the Government of India to select an officer to fill the new appointment. Fisher's post was not to be filled. The Government of India in reply (No. 104, Finance Dept., dated 11th May, 1911) proposed Mr. A. M. Caccia, M.V.O., Deputy Conservator of Forests, for the post of Director of Indian Forest Studies. Schlich retired in August, but remained on at Oxford, and Caccia was appointed for five years in the same year. His duties were to maintain a general supervision over the studies of the Indian Forest probationers at the three Universities and to personally conduct the men when on practical tours on the Continent or England in the vacations. With the outbreak of War recruitment ceased.

After the Armistice, Major Caccia, C.B. (he served during the War), was reappointed by the India Office for a further period of five years, his period of service in the appointment terminating in 1925. Even before this date the post had become to some extent unnecessary, since the Professors at the Forestry Schools took all their students, other than the Indian probationers to visit continental forests as part of their practical training.

A Commission on the Public Services visited India in 1913-14 and took evidence on Forestry Education ; the representatives of the home Universities also gave evidence before it as to the possibility of training the probationers for the Indian Forest Service in India at Dehra Dun, where a Forest Research Institute had been inaugurated in 1906. The consensus of opinion of the Forest Educational Experts negatived such a possibility owing to the fact that in the absence of forests which had been under expert management for one or more rotations, such as are found in European continental countries, the practical training would be inefficient.

The closure of Cooper's Hill brought prominently before the Universities the duty which had devolved upon them. The India Office was thenceforth dependent upon the efforts of the Universities for the supply of qualified probationers for its Service. And the Colonial Office had commenced to make similar demands. For some years previously India had been lending some of its officers to start the Forestry Departments which were being inaugurated in the territories administered by the Colonial Office. But this state of affairs could not last. The Indian Department was yearly expanding and greater demands were being made upon its staff owing to the gradually extending areas of forests placed under Working Plans and the greater complexity in detail and supervision which follows the more intensified management of forest areas. The Colonial Office had, therefore, to commence recruiting its own trained probationers.

The Universities faced the position. They recognized that a demand, which was likely to increase, existed in the country and the Empire for a thorough training in the higher branches of Forestry ; that is, for the training of the Forest Officer class, and they set before themselves the task of making provision to supply this demand.

It will be necessary to deal briefly with the steps taken to shoulder the responsibility which the Government had placed upon the Universities ; since a correct understanding of the

position existing at this period is necessary to an assimilation of the future trend of opinion in this matter. For although the writer is a Cooper's Hill trained man himself, he recognizes, with others who received their professional education at the same College, the great advantages which a University training and a University degree confer upon a Forest Officer.

When Schlich decided to remove to Oxford it was St. John's College who offered to take the foresters in and make available Bagley Wood, of some 600 acres, for practical work. St. John's erected a forestry building in 1908. A new wing was added in 1914 from funds provided by the Delegates for Forestry, the Surveyors' Institution and the Development Commission. Efforts were made to institute a degree in Forestry, but the classical tradition of Oxford did not favour the proposal. Through the energy of Schlich funds were collected towards the endowment of a Chair in Forestry, but the outbreak of war put an end both at Oxford and Edinburgh to further development. At the close of the War Oxford founded a Chair of Forestry to which Professor R. S. Troup, C.I.E., was appointed at the close of 1919. The following year Edinburgh followed suit, the writer being appointed to the Chair. Mr. A. Henry was appointed the Reader in Forestry at Cambridge, when the latter inaugurated a School in 1907. In 1912 he resigned to take up the post of Professor in Forestry at the Royal College of Science in Dublin, and Mr. William Dawson succeeded him at Cambridge. A forestry building was erected at Cambridge in 1913 from funds raised by public subscriptions, to which the late Mr. H. J. Elwes, F.R.S., subscribed handsomely. Forestry tuition is also conducted at the Marischal College, Aberdeen University (where an Ordinance for a degree has been established), and at Bangor University, but the standard was not on the same basis as that at Oxford, Cambridge and Edinburgh. The growth of the latter three schools has been much on the same lines from 1905 onwards, and may be illustrated by describing the development of the Edinburgh School.

Edinburgh, which is pre-eminently a Scientific University and an Empire University, under the Vice-Chancellors, Sir William Turner, K.C.B., and his successor, Sir Alfred Ewing, K.C.B., set herself to establish a Department of Forestry which should give the fullest scientific training required by probationers for employment in the Forestry Services of the Empire. By Ordinance a degree of B.Sc. in Forestry was established in the University in 1909. Under this ordinance

full courses in all the branches of Pure Forestry proper are given. The student takes the first science courses in Botany, Physics and Chemistry in his first year and the forestry courses and those in Applied Science, Surveying, Geology, etc., in the second and third years. During the Easter and Summer vacations throughout the three years he undertakes practical courses in woods in Scotland, England and on the Continent of Europe. At least seven months' practical work are performed. In addition to the Chair and two lecturers in Forestry, special lectureships in Forest Botany, Forest Mycology, Forest Zoology, Forest Engineering and Forest Chemistry were inaugurated, as also a course of Indian and Colonial Forest Trees. To meet an India Office requirement the Indian Forest probationers, in addition to taking the First Science Course in Pure Science, pass one of the subjects in Pure Science on an Honours standard.

At the Southern Universities a Diploma in Forestry is given, and the Indian Forest probationer is required to have in addition a Science Degree on an Honours standard. It might be suggested that the status of Forestry in the Empire would be greatly enhanced if the other Universities gave Degrees instead of Diplomas in Forestry, as is the case, outside Scotland, in America and Canada. Forestry is a Science, and a Degree in Forestry should prove of greater value to a Forester in his own profession than a pass degree in Natural Science, such as is obtainable by a large number of University students and has no special significance for the Forester.

The next point for consideration is the provision made by the University in the important matter of buildings, laboratories and so forth. Edinburgh can claim to be second to none in the country in this respect. The new Forestry building, with its large lecture hall accommodating 120 students, its several museums, laboratory and workshop facilities, students' library, and staff rooms is now well known. It was just completed at the outbreak of the War. The site and building cost £19,500, and at present prices it is easy to reckon that its value to-day is nearer £40,000 than £20,000. The equipment and fittings cost about £2000, and the same remark applies to these also. It would be difficult to estimate the value of the specimens which fill the museums. Towards this outlay, which is exclusive of museum specimens, the University furnished a little over £15,000, the Development Fund contributing £6300. The University is deeply indebted to Eardley Wilmot,

then a Development Commissioner, for his great assistance in this connection. The other expenditure on the Forestry Department proper for the period of years, 1910-11 to 1919-20, which is here alluded to, on salaries, etc., amounted to £8900 of which £6600 was furnished from University Funds and £2300 from State Funds. So that out of a total outlay during the period of £30,200 the University provided £22,000 as against £8200 received from the State. In addition the University paid from its own funds the salaries of the lecturers conducting the Applied Science subjects, Forest Botany and so forth. In the same period the sums expended on this head amounted to about £3000. For the more elementary practical courses an expert practical Forester is attached to the staff. For Practical Work Edinburgh has the use of a large nursery on the War Office Estate of Dreghorn, with woods both there and at Stobs, the Forestry Department advising the War Office on their management. They have also been granted the full use of the Atholl Woods and of the Murthly Woods by the great courtesy of the Duke of Atholl and Mr. Stewart Fotheringham.

It has proved necessary to deal at this length with the position of Forestry education in Britain owing to a question, raised by the Government of India after the War, as to the adequacy of the training received by their probationers and their expressed desire that they wished to revert to the old policy of having all their probationers trained at one centre. The reason put forward was that, owing to the Reform scheme and the new methods being introduced in the administration of India, a larger proportion of Indians would enter the Indian Forest Service in the future and it was held to be desirable that they should be trained at one centre with the Europeans. The old idea which had come up once or twice before that the probationers should be trained at Dehra Dun, was also once again under consideration.

A Conference on the training of recruits for the Indian Forest Service had been held in India on 3rd April, 1920. In a Despatch dated 12th February, 1920, the Secretary of State for India had decided that the Forest probationers should be wholly trained in India at the Forest Research Institute at Dehra Dun, as soon as adequate arrangements could be made. Fifteen days later a telegram was sent to India which indicated that the matter was not finally settled.

The Conference of the 3rd April, which chiefly consisted of Forest Officers, with Sir Claude Hill as chairman, was then

summoned to consider the question. The starting-point for discussion was the larger number of Indians who were to be recruited in future, it being considered desirable therefore that Indian and European probationers should be trained together. The whole consideration of the matter turned upon this one point, which was regarded for some reason an essential for the Forest Service, though it was not insisted upon for the other Civil Services of India. On this assumption the sanction to train at Dehra Dun was given. The Conference, however, when faced with the latter decision, realized the weighty arguments against the training in India, both professional and social, and therefore they decided : " That the representatives of the Government of India at the Empire Forest Conference to be held in London in July should be charged with representing as forcefully as possible the considerations which weigh in the balance on the side of training at home."

The Forestry Bill for Great Britain had passed through both Houses of Parliament and received sanction in 1919. The Bill appointed Forestry Commissioners, and one of the first acts of this body was to inaugurate the first Empire Forestry Conference ever held, and invite Forest Officers representing their Governments throughout the Empire to attend it. This Conference met in London in July, 1920.

Many of the members of the April Conference in India, together with Sir Claude Hill, formed the delegates representing India at the Empire Forestry Conference, and they prepared a Memorandum dated 26th June, 1920, which in part dealt with Forestry education and research. It was an excellent Memorandum, taking a broad and wide outlook of the effects of the War on Forestry questions both in India and throughout the Empire. Its pronouncements on education bore, however, the impress of some lack of understanding of the position which Forestry education had reached in Great Britain. The delegates asked for a centre situated at a University, the probationers to live together in apparently a new Forestry College to be established ; but otherwise to live the University life, and make use of University laboratories and other resources, as might be desirable. In other words, to reintroduce the policy of subsidizing one University as against the others. The Forestry Commissioners supported the Indian Government's suggestion of one centre for the higher training of Indian Forest Officers and added to it the training for all the Services of the Empire, who had no educational centres of

their own. They also advocated the centre being established apart from the Universities (a proposal which was not acceptable to the Indian delegates), but pointed out that the India and Colonial Offices would be required to provide funds towards the establishment of the centre (which it was realized would be costly) in proportion to the number of probationers they sent to it for training. The writer suggested that the training of the Forest probationers should be left at the Universities up to the degree or diploma stage. This proposal was vetoed.

This was the proposition submitted to the delegates at the Empire Conference in July, 1920, who consisted of the heads of the Forestry Departments throughout the Empire. The question of the location of the central education institution elicited considerable differences of opinion and was left in abeyance. The delegates had been divided into Committees to draft the Reports on the various matters before the Conference, the Reports being subsequently voted upon. No representative of any of the Forestry Schools in Britain was a member of the Education Sub-committee. The delegates voted for the one centre, although the representative of the Colonial Office expressed the view that his Office was content with the stamp of officer they had been obtaining during the past few years and he did not see the reason for a change involving a big outlay. The delegates representing the Indian Government stated that they were unable to commit their Government to acceptance of the motion.

It may be mentioned that the complaint of the Government of India regarding the inadequacy of the training of the Forest Officers recruited latterly scarcely concerned Edinburgh, only four Edinburgh-trained Degree men having received appointments between 1911 and the Armistice, and these had all received a forestry education before selection.

To be just to the Government of India delegates it should be stated that none of them, at the time of drafting the above alluded to Memorandum, had ever seen the comparatively recent Edinburgh Forestry Department, the building having been only just completed at the outbreak of war in 1914. This was admitted during the visit to the Department undertaken by some of the Empire Forestry delegates on the Scottish tour. The same may be said of the Colonial Office Forest Services Officers, and the remark equally applies to the progress made at Cambridge under Mr. Dawson.

The Forestry Commissioners, as an outcome of the decision

on Education come to at the Empire Conference, and as agreed upon at the time, called a meeting of the heads of the different Forestry Educational Centres in Great Britain and Ireland to discuss Higher Forestry Education and the question of a central centre. The meeting was held on September 30th, 1920. The proceedings may be briefly glanced at. The Forestry Commissioners' suggestion for the inauguration of a single centre was based on the "selection" idea, i.e. that the Commissioners, the India and Colonial Offices, should select the probationers they required from the University graduates holding a degree in pure or natural science, and send them to the Centre for two years to receive their forestry education, including the applied science training, the Universities taking no further part in Forestry education. Thus the "selection" of probationers, before they have shown any aptitude for a Forest life, or of being capable of assimilating and profiting by so specialized a form of scientific training, was to be persisted in. And yet to this prior "selection" of probationers, who may be otherwise fully qualified by social and other gifts, before they have undergone any Forestry training, may be attributed the reason for the inadequacy of the training of some of their Forest Officers of which the Indian Government complained.

The Heads of the Forestry Schools of Oxford (Troup had succeeded Schlich the previous year), Cambridge and Edinburgh were unanimous in condemning a training centre situated away from a University, as also the present "selection" system. Their chief reasons were: (1) That one centre away from a University would almost inevitably result in a narrow stereotyped teaching which the absence of a healthy competition so often resulted in. That a groove would be got into which would produce a Forest Officer of one pattern and without the necessary wide outlook which is so essential. (2) That it would be difficult to get first-class teachers to take up appointments at an isolated centre where they would be unable to mix with or meet men engaged in their own line of work. (3) That the cost of buildings and equipment of such a centre would be very heavy. (4) That the outlay on salaries, including those of Specialists in the Applied Sciences, would be extremely costly. These four points all made themselves apparent at Cooper's Hill. Mr. Dawson of Cambridge stated that in Germany, where he was trained, they were now for these reasons going back and attaching the Forestry training

to the Universities. (5) That there was no certainty that such a centre would survive any longer than its predecessors. Moreover, the centre could not be formed unless India bore a considerable share in its erection. Yet the certainty that India would continue to train men in this country, say at the end of another ten years, was, from the Indian official point of view, far from settled. Though, with reference to the latter point, Troup argued—an argument which the writer had made use of some years previously before the Indian Public Services Commission (1914)—that the Indian Forests would not be able to provide full object lessons, regular series of age classes and different types of management worked through a rotation, etc., for another fifty years. The Memorandum of the Indian Delegates to the Empire Conference also brought out this point most strongly and therefore seemed to preclude the possibility of adequately training the Forest probationers at Dehra Dun. From a professional point of view, therefore, the expert opinion of India held that it would not be possible to train the Indian Forest probationers entirely in that country. (6) The period of three years for the Science degree and two years subsequent training in Forestry was considered too long a preparation, entailing a hardship on the probationers, who would in consequence join the service at an unnecessary late age. No vote was taken at the meeting, but the views expressed appeared to be shared by other members and were promised a careful consideration by the Forestry Commissioners. There was a full agreement with the desire of the Commissioners that the Universities and other centres should undertake, as some were already doing, the training of the land owners and their agents and factors. And the statement that the Commissioners were inaugurating a number of Woodmen's Schools throughout the country was greeted with approbation.

The point therefore in this matter of higher Forestry training for the Empire which had to be settled was whether the Universities who were already undertaking the higher training, which a certain outlay would enable them to bring up to whatever standard might be desired, should continue to train the officers for these Services; or whether, if one centre was to be relied on, a centre apart from a University should be established; or, if at a University, which University was to be chosen. And, in the latter event, what compensation and in what form should be awarded to the other Universities who

had spent capital and made commitments to place their Forestry Departments on a sound basis.

With a view to ascertaining the value which the Universities attached to the maintenance of Forestry teaching at their centres, the writer suggested to the Committee that the Forestry Commissioners might address the Universities, detailing the suggested policy, explaining what they required, or what was required, in the education of the Forest Officer, additional to what he already received, and asking each University in how far they were able to fulfil the requirements ; and if not fully equipped in how far they were prepared to spend from their own funds in this matter.

This then was the momentous position now confronting Forestry education in the Empire in 1920. Canada was almost the sole portion of the Empire which was self-contained, her Forest Officers being trained at Forestry Centres at her Universities ; and Canada's representative at the Conference said that no departure from that procedure was contemplated or would receive countenance. In the outcome all but the Colonial Office and the Forestry Commission stood out, so far as the question of providing funds was concerned.

To what, it may be asked, was due the apparent sudden desire to scrap the greater part of what had taken some ten to fifteen years to build up and start out on the policy, which had so often failed in the past, of the one centre ? Forestry is no more specialized a profession than Agriculture, Engineering or Medicine. Why then endeavour to shut it up in water-tight compartments ? Had not the position perhaps arisen owing to an imperfect knowledge of the more recent growth of higher Forestry education in the University training centres ? A decade would cover the greater part of this growth. Was it not possible, perhaps, that some of the delegates, the heads of the Forestry Departments out in the Empire, many of whom had not been home for six or seven years or more, wrote the views on the training of officers contained in their Memoranda for the Conference and followed the lead of the one centre, without being actually cognizant with the position of the Universities in this matter and of the standard which Forestry training had reached in this country ?

Few of them had, it is believed, seen more than one of the three University centres ; some none ; and very few all three. Of the methods on which the men were now trained they of necessity could know little ; since it would have required some

time to detail these to them personally; and during the strenuous years of the War few of these Senior Officers had any time to spare to ascertain the position for themselves.

There were, then, in existence three active centres fully capable, in the opinion of the professional experts who were at the head of them, two of whom had been Indian Forest Officers themselves, of giving this Higher Forestry education. The cost of formation of these three Forestry Schools would, at post-war rates, probably run into some £100,000—£120,000 at the lowest estimate. Two of the centres had recently created Chairs in Forestry. A healthy competition existed between them in turning out the best type of Forest Officer.

Might it not be asked—it was asked at the time—was it not rather too late to go back to the single centre, which was virtually abandoned when Cooper's Hill was closed down fifteen years earlier, and the Universities were left the work of providing for the training of the probationers. The Forestry Commissioners, rightly perhaps, took up the ground that, owing to the large demands and applications for grants made to them by centres giving Forestry training it would be better to close down several and centralize. To a certain extent this was justifiable. But in this matter of Higher Forestry training only three Universities were at the time concerned. It was held that it should prove possible to ascertain the exact sum required for this Higher Forestry education, as apart and distinct from centres giving the more elementary training in Forestry, with which the Forest Officer has no connection.

In spite of the majority decision come to at the Empire Forestry Conference, that the training of Forest probationers should be undertaken at one centre, when confronted with the refusal of the Indian delegates to commit their Government to such a proposal, it was felt that the matter required further consideration. To this end the Forestry Commissioners appointed an Inter-Departmental Committee of which Lord Clinton, a Forestry Commissioner, was chairman, the other members being Lord Novar, Mr. (now Sir Peter) Clutterbuck, Major R. D. Furse, D.S.O. (Colonial Office), and Professor (now Sir J.) Farmer, F.R.S. This Committee took evidence from the heads of the Forestry Schools in Great Britain, and visited the centres. As an outcome it was decided to leave the Forestry training up to the degree or diploma stage at the Universities and to create a Forest Research Institute (a proposal which had received the assent of the delegates at

the Empire Conference) at one centre at which a fourth-year (or third-year for the two-year diploma) course in Forestry should be conducted. That at this centre "Refresher" courses should be given to Forest Officers home on furlough who might wish to attend them. It was decided that it was desirable that the Forestry probationers selected by the Governments concerned and delegated to take these courses should live together in a College. When the proposal was put to Edinburgh it became apparent that, as the Scottish Universities are non-collegiate, she would not be in a position to have the Institute established at her centre. At the Conference on the subject at Cambridge the University Authorities were informed that since Government were paying for the centre, Government control over the Institute would be exercised. Cambridge found herself unable to agree to such control over one of her educational Schools; and, moreover, advocated open competition. Oxford apparently agreed to accept the conditions.

India had definitely decided that she was unable to participate in the proposal of the Forestry Commissioners and stood out. It remained, therefore, for the latter and the Colonial Office, who had given its assent to come in, to provide the necessary funds. At this juncture the Geddes' Axe came down and threatened, luckily without effect, to put an end to the Forestry Commission and the new afforestation schemes in Britain. They were considerably retrenched and the proposal made no further progress. At the Second Empire Forestry Conference, held in Canada in 1923, the proposal of founding the Research Institute was again revived and the Educational Sub-committee's Report strongly insisted that this post-graduate and post-diploma year's course was a matter of urgency, and that it should be established at Oxford in October, 1924. The courses were inaugurated in that year, a Government subsidy of £5000 per annum for five years being provided for the purpose of bringing it into being, guaranteed by the Colonial Office and the Forestry Commissioners. By this time (1924) Edinburgh University had had a post-graduate course in being for three years, the Forestry graduates who had followed it having been taken direct (without receiving any Government training allowances) either into the Indian or Colonial Office Services. In the revised Edinburgh Forestry Ordinance, which received the sanction of the Privy Council on the 9th of October, 1924, this post-graduate course was made an Honours Course in Forestry.

With this explanation of the somewhat chequered history of the attempts to revise or entirely change the lines upon which the training of Forest probationers was being undertaken in Britain, it will now be possible to discuss the position in this respect which has been arrived at in India. Whilst not being perhaps all that could be desired, it is at least clear cut and displays a definite knowledge of the new conditions which have to be faced and a determination to make the best of them and endeavour to obtain the best article possible under existing circumstances.

The opinions of the Local Governments, many responsible members of the Forest Service and others, including Indians of standing in the Provinces, had been obtained on the recommendations of the Clinton Educational Report. These opinions were inevitably of a conflicting nature (*vide Government of India Proc. Forest A.*, July, 1924, Nos. 1-23). In September, 1922, both the Indian Legislative Assembly and the Council of State had passed Resolutions recommending that the training of Indian Forest probationers should in future take place at Dehra Dun.

It will be remembered that a Commission visited India in connection with an enquiry into the Public Services in 1913-14. The Islington Commission as it was termed wrote its Report in August, 1915. The Great War was then being waged and, so far as the Forest Department was concerned, no attempt was made to give effect to the recommendations made.

The next Royal Commission to consider, amongst others, the position of the Department was the Royal Commission on Public Services under Lord Lee, 1923-4. Matters connected with the organization and the recruitment of the special Forest Engineer branch will be considered later. On the subject of recruitment and training the Royal Commission made some startling recommendations which materially alter the position of the Department in some important points. But many of these were based on the Islington recommendations.

The procedure in force for recruitment in 1914 had come to an end with the War. After the Armistice the India Office recruited probationers from amongst the officers who had served, selecting them in order of war seniority from 1914 onwards and sending them to the three Universities for training. But it was regarded as necessary to give effect to the orders passed on the recommendations of the Islington Commission, and in 1920 the recruitment for the Indian Forest Service

was made (a) by direct appointment in England and India and (b) by promotion from the Provincial Service in India. Under the latter all Extra Deputy Conservators considered fully qualified to hold a major post were promoted to the Indian Forest Service from 12th March, 1920. This step, perhaps not unnaturally, caused considerable heart-burning amongst the officers in the Service who were thus superseded. Though, as a matter of fact, since they were on an incremental scale of salary and the men so promoted were of long service and would rarely reach administrative rank, the hardship was in most cases more apparent than real.

The recruitment in England and in India of candidates nominated for direct appointment was carried out under the regulations laid down by the Secretary of State and the Government of India respectively, and the candidates who were successful in their studies and passed the medical examination were appointed Assistant Conservators of Forests under covenant with the Secretary of State. Candidates for direct appointment in England were required to have obtained a degree with honours in some branch of Natural Science in a University of England or Wales, or a moderatorship in Natural Science or in Experimental Science at the University of Dublin ; or to have passed the final B.Sc. examination in Pure Science in one of the Universities of Scotland. Graduates in Forestry at the University of Edinburgh were regarded as satisfying the conditions provided they passed the Final examination of the University in some one branch of Natural Science embraced in the Pure Science Syllabus.

The above qualifications were not insisted on by the India Office to the full in the case of European candidates, who had rendered war service, recruited as a special case both in England and in India during the years 1919, 1920, 1921 and 1922. In the case of the probationers sent to Edinburgh, however, the University Senate, whilst inaugurating and according a temporary diploma to War Service men for two years' work, insisted that the candidates should pass in two science subjects, Botany and Chemistry (ordinarily taken by the Forestry student in his first year at the University) in addition to performing the whole of the second and third years' work for the degree. The only War privilege granted was to ex-service students who could satisfy the Faculty of Science that they had carried out studies in Zoology and Physics on a standard sufficient to enable them to be granted a pass for

these two subjects. In such cases the probationer graduated in Forestry instead of taking a diploma only.

For the candidates recruited in India the years 1920 and 1921 were experimental and different qualifications were prescribed in order to meet provincial requirements, but the possession of a High Bachelor's Degree was insisted on. From 1922 candidates were required to possess an Honours or a First-class Degree in Science of a University incorporated by Law in British India.

It will be readily understood that after the Armistice the recruiting problem was a very urgent one. During the War many young Forest Officers went on active service. Some were killed or incapacitated by disease or wounds. During this period the more senior men carried on as best they could, holding charge of several Divisions, whilst members of the Provincial Service were in charge of others. It was a period of marking time. No advance could be made in Forestry Administration. The Munitions Board also absorbed a number of the more Senior Officers. Recruiting was suspended during the five years of the War. It was scarcely surprising, therefore, to find every Local Government demanding recruits to man its Service. In the four years 1919-23 the annual number of probationers recruited for training in Europe was: 1919, U.K. 38 (one resigned). 1920, U.K. 28; India 4 (1 died). 1921, U.K. 21; India 30. 1922, U.K. 10 (one died); India 16 (5 resigned). 1923, U.K. 9 (1 resigned); India, 5.

The Government Memorandum of 25th October, 1923 (prepared for the Royal Commission on Public Services), dealing with the limit to the number of officers recruited in India, reads as follows: "(a) The percentage of direct recruitment of Indians has been fixed at forty for India and twenty-five for Burma for a period of five years from 1921, and applies to Indians recruited both in England and in India. If the full number of Indians is not available in any one year, the balance is carried forward to the next year, and if suitable Indian candidates fail to present themselves then, the number required to fill the existing vacancies at the time is added to the non-Indian total, and recruited in England. It has been decided that the recruitment of Indians in England should cease after 1924. The same arrangements apply in the case of Burma recruits. (b) Recruitment by promotion from the Provincial to the Indian Forest Service is limited to 12.5 per cent of the posts in the latter Service, this proportion being treated as

'listed posts,' and rests with Local Governments who make promotions on the ground of exceptional merit and promise, irrespective of seniority."

As regards the allocation of Assistant Conservators to the Provinces after completion of training, the old plan of allowing the men to choose the Province they preferred, according to their seniority on the list after a final examination, had been reverted to. It had been introduced after the War in order to decide the competition for the Currie Scholarship, which dated from Cooper's Hill days, and to place the men from Oxford, Cambridge and Edinburgh in order of seniority. The 1923 Memorandum stated that this procedure had been modified in order to secure, so far as possible, an even distribution of recruits in order of merit among the various Provinces and was primarily governed by the needs of the Public Service.

With reference to the selection of probationers in Britain the plan of appointing a Selection Board at the India Office was still adhered to. This Board was nominated each year and interviewed personally each candidate who had satisfied the India Office that he possessed the necessary qualifications to appear before it.

With regard to the probationers recruited in India after the Reform Act, Provincial Governments nominated the qualified candidates after selection with the assistance of Selection Committees constituted by them, and final selection was made by the Government of India from candidates so nominated, due precaution being taken to guard against the undue preponderance of any one class or caste, or of candidates from any one Province. Modifications of this procedure have since supervened in the case of Burma and Bombay, where, owing to the forests having become a transferred subject, the Local Governments have now the onus laid upon them of selecting their own recruits for the Service (1925).

On the subject of training, the regulations for appointment were as follows: "Before appointment to the Indian Forest Service probationers recruited directly in England and in India are at present trained at the Universities in the United Kingdom and are required: (1) to have obtained, either before selection as probationers or within the prescribed probationary period (usually two years), the degree or diploma in Forestry at Cambridge, Edinburgh or Oxford University. Probationers may elect to spend the probationary period at any one of these Universities; (2) to have undergone a special course of

instruction in Forestry under the direction and supervision of the Director of Indian Forest Studies appointed by the Secretary of State for India in Council ; (3) to have passed an examination in Forest Engineering, and, if required, in certain special subjects, namely, Systematic Botany of Indian Trees, Indian Geology, Forest Law, Indian Working Plans and an Indian vernacular language ; (4) to have undergone a final competitive examination in Forestry ; (5) to have concluded an agreement."

Allowances were paid to selected probationers during their course of training, and it appears probable that the payment of these allowances could have been dispensed with at an earlier date. For instance, probationers were selected from Edinburgh, both Europeans and Indians, in 1922, 1923 and 1924 from men who had themselves defrayed the whole of the cost of their training. On the subject of allowances and age the 1923 Memorandum reads: "The amount of the allowance was raised to £150 per annum in 1919 and to £200 per annum in October, 1920. From 15th October, 1921, it has been raised to £300 per annum for European probationers and to £350 a year in the case of probationers of Indian domicile. It is to be reconsidered in 1923 with a view to possible reduction with effect from October, 1924. Since 1917 each probationer has been provided with a free first-class passage to India." The allowances granted from 1921 together with the travelling allowance allowed during the practical courses in England and on the Continent were high, and proved, in cases at least, an absolute deterrent to the probationer giving his whole energy to the work in hand.

The age limit for the recruitment of probationers in England had remained unchanged at 19-22 years on 1st January of the year of selection, except in the case of European probationers who had War Service. These were recruited during 1919, 1920 and 1921 between the age limits of 19 and 27 on the 1st July of the year of selection and 19 and 25 in 1922. Candidates recruited in India were in 1920 required to be not more than 23 and not less than 20 years of age on the 1st January. From 1921 the age limits were 19 and 23 on the 30th June of the year of selection.

This was the position of the training of Forest probationers up to the end of 1924. But the future of this question had remained undecided in 1923, as may be gathered from the following paragraph in the Memorandum of 1923: "In view

of the practical difficulties in securing the joint training of European and Indian recruits at one institution in England which is considered essential to ensure harmonious working and to give Indians the same opportunities as Europeans, the question of the place at which these recruits should be trained in future is at present under consideration."

The factor which was to weigh down the balance of this settlement and to decide it the time being was the strong wish of Indians that the training should be conducted at Dehra Dun. Before dealing with this, the latest, decision in the matter it will be necessary to glance at the Indianization of the Service which was taking place, since this had a material influence on the decisions arrived at. The 1923 Memorandum deals at some length with this factor: "(a) Before 1920 the only avenue of appointment to the Indian Forest Service ordinarily open to Indians was that of direct appointment by the Secretary of State after selection and examination in England. With two exceptions (Mr. F. R. Dasai who joined in 1869 (*vide* II, pp. 54, 175) and Mr. N. Gustasp who was appointed from a post in the Provincial Service in 1907) no Indians entered the Indian Forest Service between 1866 and 1910. Thereafter one joined in each of the years 1911, 1913, 1915 and 1919. (b) In 1920, in consequence of the recommendations of the Islington Commission, the Secretary of State sanctioned the following alterations affecting the appointment of Indians: (1) 12½ per cent of the directly recruited posts in the Indian Forest Service in each Province were to be regarded as listed appointments to be filled by promotion at present and future members of the Provincial Service other than those who were then Extra Deputy Conservators, who were also to be promoted at once if qualified. (It may be noted in this connection that all officers who joined the Provincial Service after the 1st January, 1894, were statutory natives of India.) (2) In 1920 40 per cent of the vacancies for probationers directly appointed by the Secretary of State in England were to be reserved for Indians if available. (In the result four Indians out of a total of twenty-nine recruits or 14 per cent were so appointed.)"

From 1921 onwards up to $\frac{40}{25}$ per cent of the vacancies for direct appointment were to be filled by $\frac{\text{Indians}}{\text{Burmans}}$ recruited both in $\frac{\text{India}}{\text{Burma}}$ and in England.

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In according sanction to these arrangements designed to protect the interests of Indian candidates the Secretary of State *emphasized his inability to admit any relaxation of the principle that the then existing high standard of the Indian Forest Service must be maintained, and that any further increase of the proportion of 40 per cent of Indian recruitment, and even the continuance of that proportion, must depend on the availability of sufficient Indian candidates of the required type.* At the same time, while agreeing to the request of the Government of India, that an enquiry as to the suitability of the 40 per cent limit for the recruitment of Indians *should be held after five years,* the Secretary of State pointed out *that evidence on which to form a definite opinion was not likely to be complete within that period.* (c) Present proportion of Indians. The following statement shows the position on the 1st July, 1923 :

(1) INDIA (EXCLUDING BURMA)

	No. of Posts filled.			Total No. of posts sanctioned.	Percentage of Indians of total No. of officers in service.
	By Europeans and Anglo-Indians.	By Indians (or Burmans)	No. of posts vacant.		
Listed posts	11	17	4	32	61
Directly recruited posts	183	10	55	248	5
	—	—	—	—	—
Total	194	27	59	280	12

(2) BURMA

Listed posts	13	—	1	14	—
Directly recruited posts	72	—	33	105	—
	—	—	—	—	—
Total	85	—	34	119	—

A considerable number of Indian probationers were under training at the Home Universities at the time and are not consequently shown in the above table.

As regards the Indianization of the Imperial Service, the Islington Commission recommended a ratio of a total of 37½ per cent for Burma and 52½ per cent for India. The agitation in India, which found its expression in the non-cooperative movement and in the demand for a more rapid Indianization

of the Services gave rise to very considerable difficulties. Not the least was the uneasiness which arose in the minds of the British officers in the Services as to the security of tenure of their appointments and pensions which was reflected at home in the recruitment falling off both in numbers and qualifications of the candidates presenting themselves for Service in India. The Government faced the serious position by appointing a Royal Commission on the Superior Civil Services in India (commonly known as the Lee Commission) whose Report is dated 27th March, 1924. The cost of training a probationer at Dehra Dun was estimated at £2000. In their letter, No. 2 Forests, dated 21st February, 1924, to the Secretary of State, the Government of India definitely decided to train all probationers at Dehra. In reply to a telegram, No. 1623, of 30th May, 1924, from the former, asking for certain additional information the Indian Government telegraphed (No. 402, dated 21st July, 1924) that before deciding they would await the Lee Commission's Report. The proposals of the Government of India, based on the Report which was admittedly a compromise between the British and Indian views, received the assent of Parliament [Government of India (Civil Services) Bill] in December, 1925. On the subject of the Indian Forest Service, para. 39, p. 22 of the Report, the Commission made the following recommendations: So far as this Service is concerned we endorse the views expressed by the Islington Commission to the effect that every effort should be made to discover and recruit competent men in India, and that it should be possible to meet the whole of the normal requirements of the Imperial Branch in India within a reasonable period. Since that Commission reported, arrangements have, we are informed, been made which will ensure that the instruction and training available at the Forest Research Institute and College at Dehra Dun will be not inferior to that obtainable in other parts of the world. We further understand that instruction and training of the superior scale contemplated will be commenced in 1925." (This matter had not been definitely settled in 1925.) "In Burma also a forestry course has been inaugurated at Rangoon University. The percentage of direct recruitment of Indians for the Indian Forest Service has been fixed at 25 per cent for Burma and at 40 per cent for the rest of India. This includes Indians recruited both in England and in India. In addition, 12½ per cent of the posts on the cadre are filled by promotion of officers from the

Provincial Forest Services. Taking all these factors into consideration, we recommend that recruitment should henceforward be in the ratio of 75 per cent Indians and 25 per cent Europeans in those Provinces in which Forest Administration is reserved. As regards Bombay and Burma, we have already expressed our view that the future recruitment of officers to perform the duties and functions at present carried out by members of the Indian Forest Service should be left to the discretion of the Local Governments concerned."

It is impossible to credit that these proposals were based on the recommendations of the professional administrative Forestry Advisers of the Indian Government. In the past the Indian has shown no desire to enter the Indian Forest Service. It is only since the salaries have been considerably augmented that he has commenced to look to the Department as a means to earn a good salary. There is a total lack of experience as to how he will acquit himself in the higher posts in the management of an estate of such high value as the forests. The work is technical and difficult and the life of constant exposure and isolation, one which requires a high stamp of man morally and physically. There are some magnificent Indians in the Department who have proved their worth in the Provincial (and have been promoted into the Imperial) and subordinate services. But they would be the first to admit that they have always had the guidance and help in difficulties of the British officer to hand. Can the Indian gentlemen, who are now responsible for a share in the administration of the Government of India, really intend to jeopardize such a valuable source of revenue and such a vital factor to the country at large as the Forest Estate by risking the future of a Service to a shibboleth? As a Forest Officer of some experience the writer would like to submit for their consideration that the service of the forests, like any other service, produces its own type, and that the keen and enthusiastic Forest Officer pays little regard to the nationality of a confrère once he realizes that he knows his métier. Let but the right type of Indian come into the Indian Forest Service and there can be little doubt that he will be welcomed and there will be little need for arbitrary percentages of Indians and Britons. But he must be the right type, he must know his job, and he must be prepared to take his full share of the hard work, exposure, isolation and responsibility. The work of the British officer, assisted by some fully efficient members of the Indian

subordinate staff, is there for all to see. Beyond dispute it is magnificent work. It should not be jeopardized and it need not be jeopardized. Arbitrary recruitment according to percentages of Indian or European must inevitably jeopardize it because the staff of the Indian Forest Service in the future, if the highly skilled work now required to manage the Forest Estate is to be carried on, *must all be picked men*. This high level cannot be obtained or maintained if recruitment is tied down to percentages. It is the negation of high efficiency. After his recent tour of India the author does not believe that statesmanship in India is on the decline. Rather it would seem to be on the road to a higher level than even the past has shown. To the management of the Forests, he would submit, the widest vision and the highest statesmanship is required, both in the Central and the Provincial Governments, if this great safeguard and insurance to the country and its people is to be maintained on the highest level of efficiency and to be at the same time an increasing source of wealth.

It has been mentioned above that India had kept pending the decision on the future methods of recruiting and training the probationers for the Service, apart from the percentage to be promoted from the Provincial Cadres. The solution has proved a difficult one owing to the very conflicting opinions expressed and to the fact that it had to some extent become a political one. It is based on a compromise, like so many other matters, as the outcome of the Lee Commission Report. It has been already pointed out that the desire of Indians, expressed for several years past, was that the training should be given entirely at Dehra Dun. The proposal was not a new one. It was first given expression to in 1868 (*vide* Brandis and Government of India, II, p. 58). The author has given evidence before several Commissions on this matter and has also discussed it with numbers of influential Indians. His views are therefore known. In India he was able to make himself acquainted with the various currents of opinion held on this subject, both in the Provinces and at Simla. But the deciding factor which has settled the matter for the time being beyond, apparently, further argument is the decision of the Legislative Assembly and of the Council of State that the training of Indians for the Indian Forest Service should be given at Dehra Dun. This being the existing position, those who have the true welfare of India's great Forest Estate

at heart should endeavour to find the best and surest way to forward to the best of their ability the objects to be attained. Subject to the assent of the Secretary of State, the British probationers for the Service will in future be selected from the men holding either a B.Sc. degree or a diploma from the Universities of Oxford, Cambridge and Edinburgh, whilst, commencing from October, 1926, the Indians will be trained at Dehra Dun.

With regard to the British probationers there appeared to be no longer any necessity to go to the expense of granting them training stipends. They would be readily obtained fully trained from the Universities in the open market. And a better stamp will in the general run be available since these men will have selected and trained themselves for a Forestry career on their own initiative and not have taken to it merely because they had the good fortune to secure a Government probationership which carried with it a grant to cover the cost of their education. This will save the Indian Government a considerable expenditure which has not always proved a necessity in the past. It was realized that this settlement of the matter would no longer necessitate the maintenance of the Director of Indian Forest Studies. The final examination held with the object of placing the selected probationers of any one year in order of merit may well be held under the ægis of the High Commissioner who would choose the examiners to conduct it.

The above applies to the probationers for the Service who will be required by the Government of India. Since in Bombay and Burma the Forests are a transferred subject these Governments will doubtless make their own arrangements for recruiting British members for their staffs. It may be inferred that they will also go to the open market at home.

It has been decided to train the Indians at Dehra Dun. The facilities to be found there will be readily appreciated from a perusal of the next chapter dealing with the Forest Research Institute. As will be shown later on, the two classes being trained at Dehra at the present time are the Provincial Class and the Ranger Class. The training to be given at Dehra Dun will consist of a two-year Diploma Course in Forestry and Allied Science subjects. Presumably the selected probationers will be men who have already graduated in Science at an Indian University of recognized standing. This should be rigidly adhered to, the degree demanded including Botany and

Zoology, and if possible Chemistry or Physics or both. It may be suggested that every effort should be made to start this course on as high a standard as possible and to lay down that the examinations should be conducted by an internal examiner and an external one of known repute. It cannot be too strongly pointed out that the future value of the Indian officers and the management of the forests of which they will have charge must depend on the thoroughness and high standard of the courses given for the diploma and on the standard reached by the probationers following them. At first the selected probationers will draw grants to enable them to follow the diploma courses. It is hoped, however, to make the diploma of such value to India that Indians will follow the course at their own expense, looking to obtaining appointments when they have become qualified. Once this aim has been achieved it should go a long way towards securing the desired stamp of recruit for the Indian Forest Service, the man who enters the Service from a love of the forest and the life and work to be found within it.

It has been said that it is hoped to start the course in October, 1926. In order to provide the necessary accommodation part of the Research Institute building, frontispiece (the Research Institute is being removed to a more spacious site), is to be converted into lecture rooms, laboratories, with a large club room for the probationers and other accommodation. The existing handsome block of quarters occupied by the Provincial Classes will be improved and made available for the Indian probationers. The cost of these alterations has been estimated at a lakh of rupees and the annual cost of the training at another lakh of rupees. If there are twelve probationers in each year it is estimated that half a lakh of rupees will be secured from them in tuition fees (to be paid in the first instance by the Governments who nominate them), the annual outlay to be incurred by the Government of India being thus half a lakh. A difficulty which has to be faced in connection with this projected diploma course is the fact that already in Bombay and Burma the forests are a transferred subject. In other words, the Local Governments of these Provinces can obtain their probationers from any source they please. If the other Provinces were to follow suit (this matter has been discussed already) the Government of India might find themselves left with a diploma course, staff and buildings, and no probationers to follow it. This danger has to be faced, and in the writer's

opinion the Government are wise to face it. If the course is really efficient the diploma will soon have an assured value throughout India, both for the Forest Service and the Indian States. Moreover, it is the wish of the Indian Legislative Assembly and Council that Indians should be trained in India. No Local Government could afford to run a diploma course in Forestry of any value to train a few recruits per year, owing to the enormous expense involved. The future of the course and the value of the diploma should be assured provided the standard of tuition and examination is maintained on a high level and that the greatest care is exercised in the selection of probationers to follow it. On securing a diploma and passing into the Service an Indian Assistant Conservator will, it is intended, do three years' work in a Forest Division and will then be sent to Europe to visit Continental forests and carry out such studies as may be prescribed for him. This is to be laid down as an integral part of the Dehra training. It is proposed that this additional training in Europe shall be carried out under the supervision of such University Forestry centres as are able to provide the type of education required.

It has been already stated that one of the objects for which the central Forest Institute was to be inaugurated in Great Britain was to afford "Refresher" courses, as they were termed, to Forest Officers whilst at home on leave. For many years the Government of India gave facilities to officers on furlough, by paying travelling expenses, who wished to visit European Continental forests for the purpose of study. The provision was abrogated towards the commencement of this century owing to the fact that in the absence of supervision or guidance the visits so paid possessed little educational value. But special sanction could always be obtained provided a definite object and programme was laid down. In view of the fact that a proportion of the Indian Forest Service will now be recruited from members of the Provincial Service, and that a number of the junior officers in the Service, who had joined in the years immediately after the War and whose training cannot be said to have been (in all cases) on the high standard which is indispensable for the Service of to-day, it has now been decided to recommend such officers taking a course of study whilst on leave. Officers desirous of taking advantage of the provisions will send in their names the year previous through their Chief Conservator and Local Government, who will forward them to the Government of India. The latter Government will make

such arrangement as will be necessary with the University Authorities in Great Britain and will signify the particular line of study the officer wishes to follow. It is not desired that the officers shall be limited to one centre only. In fact the wish of the Government of India, it is understood, is that they should have at their command more than one centre in Great Britain to which these officers, as also the Indian Diploma Forest Officers, may be deputed, provided that such centre can give the particular course prescribed and undertakes to provide personal supervision throughout the whole of it.

Thus it would seem that the rather tangled skein into which this matter of Forestry training had become involved has become straightened out, and although the present solution is admittedly a compromise yet there appears no reason why with hard work and good will on all sides success should not be reached. Provided always, for this must be the governing factor to success, the right stamp of Indian comes forward to enter the Service.

The Indian Forest Engineering Service.—The creation of the Forest Engineering Service was sanctioned in 1919 with the object of developing the forests and of introducing more efficient methods for the extraction and disposal of timber. The directly recruited candidates in England, sixteen in number and mostly ex-Service War Officers, were sent for training to America and Canada, where they spent about a year under the supervision of Mr. C. G. Rogers, C.I.E. On return to England some went to Switzerland under a P.W.D. Officer to study portable saw mills and wire ropeways, whilst the rest paid visits to British saw mills. The total cost of the training amounted to £1728 per head. When this Service was created it was anticipated that as engineering work developed it would be found necessary to create higher appointments which would afford adequate promotion. In 1923, however, the Government of India (Memorandum for Lee Commission) wrote: "Owing to various circumstances the outlook as regards the method of exploitation has now altered and there seems to be no prospect of an early expansion of this Service so as to constitute a self-contained unit, wide enough in its scope to satisfy the legitimate aspirations of its members." The Local Governments were being consulted in the matter. So far as could be gauged in 1925 it appeared as if the latter would resolve things for themselves and create Provincial Forest Engineering Divisions, already in existence in one or two cases, to carry out their own

work. There can be little doubt that the advent of the Forest Engineer has been of enormous benefit to the Divisional Forest Officer.

2. THE PROVINCIAL SERVICE

Up to the year 1906 the Provincial Service was recruited by the promotion of Rangers of proved meritorious service. When the Research Institute came into existence in 1906 the status of the Imperial Forest School was raised to that of Imperial Forest College. In the same year under orders of the Government of India, a third-year course was inaugurated at the Forest College for training selected Rangers for admission to the Provincial Service, it having been felt that these officers, who would subsequently hold charge of the Forest Divisions classed as minor charges, required a more intensive training than that given to the Ranger. Experience soon showed, however, that the education which could be grafted on to the Rangers' Course during a third year was far from satisfactory. In the year 1912, therefore, a separate two-years' course was started at Dehra Dun. This course has persisted to date.

When the Imperial Forest Research Institute was established in 1906 the staff attached to it consisted of six officers. A Sylviculturist, Superintendent of Forest Working Plans, Forest Zoologist, Botanist, Chemist and Economist. One of these officers, Mr. J. H. Lace, C.I.E., the Sylviculturist, held the post of Principal of the College in addition to his other duties. It was laid down that the Research Officers should lecture to the Ranger Class in their several subjects, the officers holding the post of Instructors being four in number, selected from the Provincial Service. This did not prove satisfactory. When the separate course was started for the training of the Provincial Service the Staff of Instructors was raised as follows :

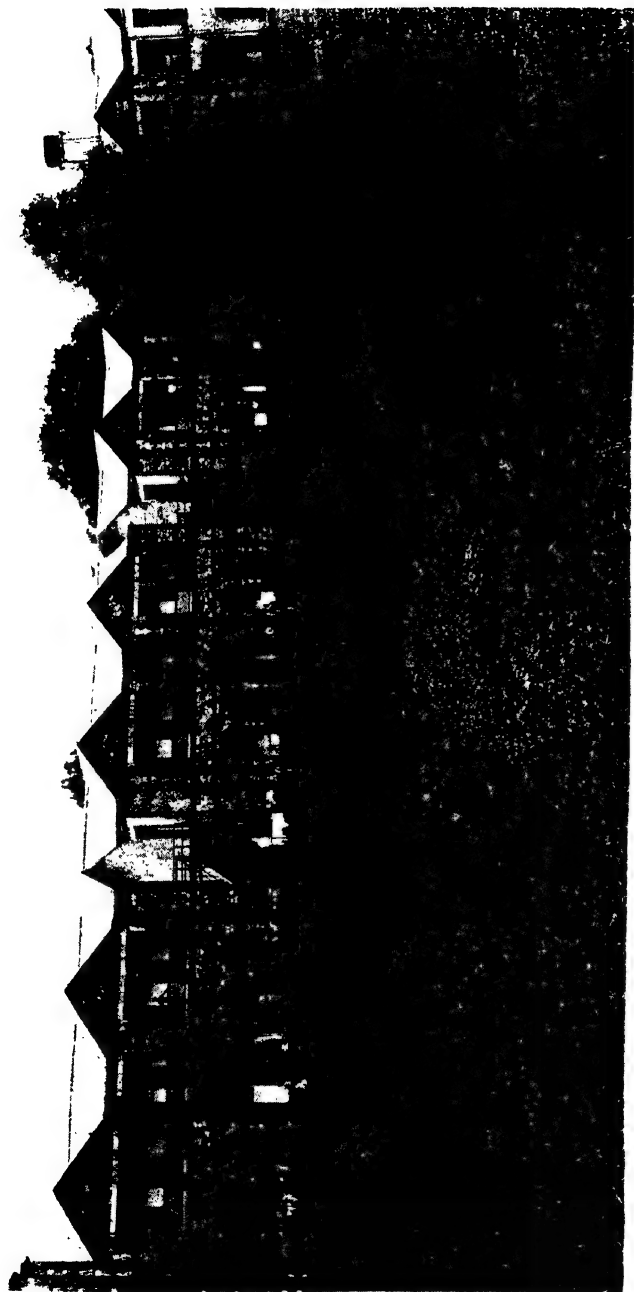
Two Instructors (from the Imperial Service) for the Provincial Service Class. Two Instructors (Imperial Service) for the Rangers' Class. Two Assistant Instructors (Provincial) for the Rangers' Class. One Ledgering Officer (Provincial).

It will be seen that the change made in 1906 of dispensing with the Imperial Officer Class of Instructor and relying mainly on the Provincial Instructor proved inadequate. The Research Officers gave courses of lectures and spent short periods in camp with the classes. But efficiency in teaching deteriorated. The old system of having two Imperial Service Instructors for this class was therefore reverted to.

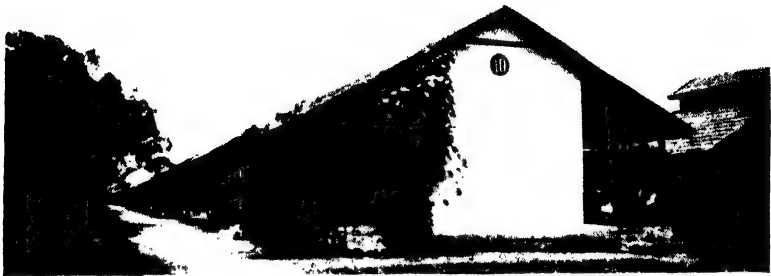
The recruitment and training of officers for the Provincial Service is now a matter for regulation by the various Local Governments. It is open to Local Governments, on payment of the fees, which in 1923 were fixed at Rs.1750 annually for each student to Dehra Dun and Rs.1500 at Coimbatore (the fees were the same in 1925), to depute candidates to undergo the course provided they are qualified for admission under the rules governing the course. Unfortunately, in the past, the selection of candidates by the Local Governments has not been all that could be desired. But this has often been due to the impossibility of getting the right stamp of men to come forward.

The question now under consideration is the future position of the Provincial Service and its method of recruiting. The rank of Extra Deputy Conservator of Forests has practically disappeared with the promotion of all the efficient members of this grade. The grade will not, it is understood, be revived. The Indianization of the Indian Forest Service and the training of the Indian recruits at Dehra Dun will make it impossible to continue to maintain the Provincial Class in that station, since there will be little difference in social position, so far as can be foreseen, between probationers following the diploma course and those taking the Provincial Service one. Moreover, with the considerable influx of Indians into the Indian Forest Service, it becomes doubtful whether the Provincial Service as it exists to-day will have any justification in the future. Rather it would appear advisable to revert to the former state of affairs (cf. II, p. 507) and maintain this Service for the promotion of good Rangers to Extra Assistant rank, and from that rank into the Indian Forest Service in the case of men who give evidence of first-class ability. The Provincial Class was brought into being to fill an admitted want of the times. With the changed position of recruitment it would appear that this requirement has disappeared. These remarks apply to the Services under the Government of India.

In Burma a Provincial Service Class was inaugurated at the new Rangoon University in 1923. Intermediate arts is the qualification and a two-years' course prescribed based on that at Dehra Dun. Two Imperial Instructors, Messrs. R. Unwin and J. W. R. Sutherland, are in charge of the Forestry part of the curriculum and the first set of probationers are commencing their second year's work (1924-5). The cold-weather months are spent on practical courses. This step, first mooted in 1916 and again in 1918, 1920 and 1921, when both Hart and Perree



STUDENTS' QUARTERS, PROVINCIAL SERVICE CLASS. FOREST RESEARCH INSTITUTE, DEHRA DUN
Research Institute. photo.



MADRAS FOREST COLLEGE HOSTEL.



MADRAS FOREST COLLEGE HOSTEL—SHOWING ONE OF THE ELEVEN BLOCKS

C. R. F. Williams, photo.

visited Burma, was forced upon the Government of Burma owing to the Burmans' strong prejudice against going to Dehra Dun and to the considerable number of provincial officers required for Burma. The Malay States are taking advantage of this course. The candidates are selected by a Selection Board. The Chief Conservator and one Conservator are members of the Advisory Board. The progress of this first attempt to graft forestry education on to a new University in the East will be watched with the highest interest.

3. THE RANGERS' CLASS

In a previous chapter (II, p. 505) the origin of the famous Rangers' Class at Dehra Dun has been dealt with in full. That training has been of inestimable value to the Department throughout the whole of India and has resulted in producing some first-class men. The coming of the Research Institute, or was it the Provincial Service Course, undoubtedly, in the opinion of many, had its repercussion on the standard of training of the Rangers, which fell off to some extent from its former high grade. Another reason perhaps for this decline may be found in the much larger classes which had to be taught owing to the growing demand of the Local Governments. In 1912 a relief was found by the establishment of the Madras Forest College at Coimbatore, since it was found impossible to train as large a number as thirty probationary Rangers, the number required for Madras alone. This departure has resulted in a fine College coming into existence in the Southern Presidency. In 1920 it was decided by the Government of India in correspondence with the Madras Government that the area for recruitment and training of Rangers should be divided between the Northern and Southern Colleges. It was agreed that the Dehra Dun College should train candidates from the Punjab, North-West Frontier Province, the United Provinces, Bengal and Assam, while the Coimbatore College should be open to candidates coming from Bombay, the Central Provinces, Bihar and Orissa, Orissa Feudatory States, the Central Indian States and Native States of Southern India, including Hyderabad. From 1893 to 1903 Extra Assistant Conservators and Rangers for Bombay were trained at the Poona College of Science, where there was also a Foresters' Class. This class was stopped in 1903 and probationary Rangers were sent to Dehra Dun. Until 1917 (in other Provinces it commenced in 1913) Extra Assistant Conservators were appointed from the

Ranger Class. Thereafter direct recruiting for the Provincial Service commenced, only a proportion of Rangers being promoted into that Service. The Dharwar Rangers' two-years' course was started in April, 1920, for much the same reason that the Madras College came into being. The Bombay Course was retrenched two years later and with the arrangement now in force with Coimbatore there does not appear any prospect of the Dharwar project being restarted in the near future.

It was proposed in 1921 that the Rangers' College in Dehra Dun should be handed over to the United Provinces in 1922. This project did not materialize. It appears possible, however, that it will take place, and the suggestion is that the Rangers' Class should be removed to the neighbourhood of Bareilly, probably Clutterbuck-ganj, and thus leave the home which saw its birth and has witnessed the development of forty years. Its maintenance at Dehra would, it was said, be incompatible with the training of the Indian Forest Service probationers at that station.*

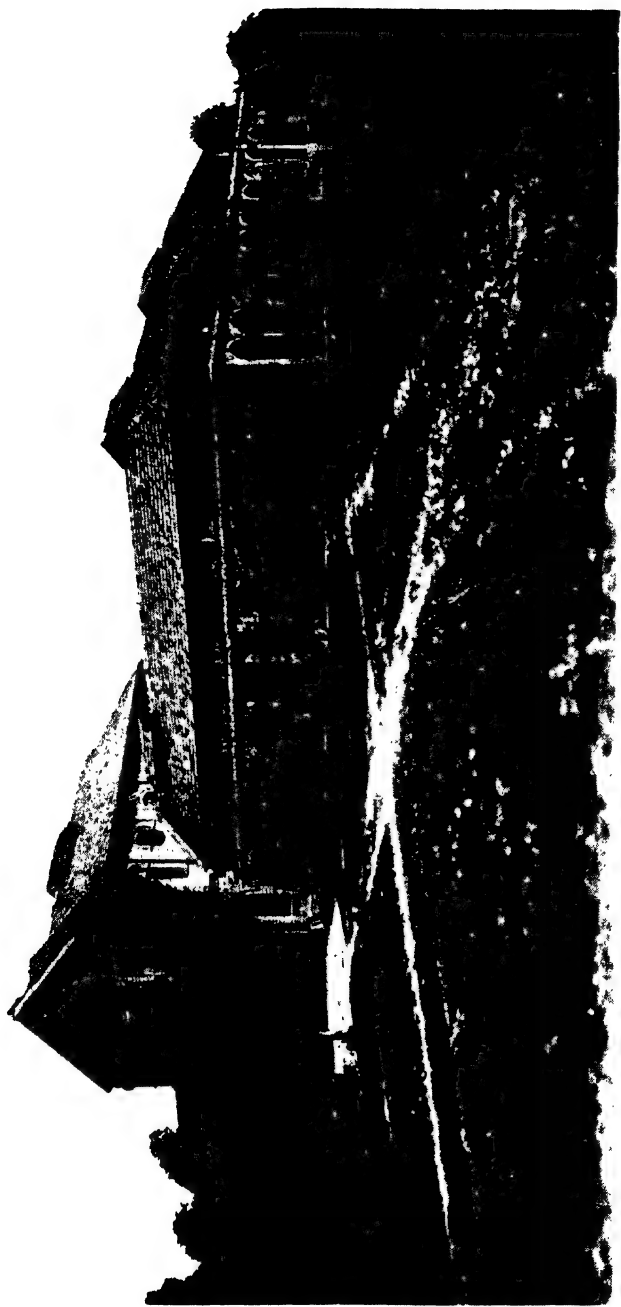
The Madras Forest College at Coimbatore was first started in 1912, courses in English being given for the grade of Ranger as at Dehra Dun. It was then housed in the old Local Municipal buildings. The foundation stone of the new College building was laid by Lord Pentland, Governor, in April, 1913, and the building was opened two years later. The Museum, known as the Gass Forest Museum, was first inaugurated by Mr. Gass, Conservator, in 1901. The present handsome block of Museum buildings was sanctioned in 1905 at the instigation of the Governor, Sir Arthur Lawley, and completed in 1906 at a cost of Rs.8860. Thus at Coimbatore the fine Museum buildings preceded the erection of the College. Eardley Wilmot when he visited Madras in 1908, as Inspector-General, passed a high eulogy upon the Gass Forest Museum. The earliest inception for the foundation of a College was due to Mr. F. A. Lodge when Conservator (he was also responsible for obtaining the Chief Conservatorship), in a letter dated 11th December, 1917 (*vide History of Madras Forest College*, to which reference should be made for further details). The College building contains a large hall, the Gamble Hall, ample lecture-rooms and laboratories, mostly bearing the names of former distinguished Madras Forest Officers (such as, e.g. Cleghorn, Beddome, etc.), a fine library with carved

* It is to be left at Dehra, *vide* p. 305.



GENERAL VIEW OF THE MADRAS FOREST SCHOOL AND GASS MUSEUM BUILDINGS, COIMBATORE, MADRAS PRESIDENCY, 1925

C. R. F. Williams. photo



MAIN BUILDING OF THE BURMA FOREST SCHOOL, PYIN OMANA. PHOTOGRAPH TAKEN JUNE 1922

H. R. Blanford, photo

bookcases, and the necessary offices. The entrance hall or lobby contains some magnificent panelling. The two blocks of buildings, College and Museum, face each other, separated by some hundred yards or so, and have a natural setting which adds to their architectural beauties which are considerable. From the flat roof of the College the famous Anamalai Hills, often alluded to in this history, can be seen on the one hand, and the hills of the Palghat evergreen forests on the other. Both these regions, it will be remembered, carry one back to the earliest days of forest exploitation in Madras. Quarters for the whole of the officers and personnel are provided in the grounds which comprise an area of 140 acres. The students' quarters are arranged in blocks, each block containing accommodation for six students, comprising: (1) a building divided into six rooms connected by a covered way to (2) a mess-room at the back, the latter connected by a covered way to the kitchens. Behind again, and set back, are the latrines. There are eleven blocks of these quarters placed in a row, each unit being separate in itself. There is a fine club-room and a gymnasium. The students wear uniform and drill under two havildahs. A Forest Nursery is maintained and the College grounds have been divided into compartments which are stock mapped and yield fuel. Unfortunately the soil is black cotton and poor for tree growth. Since the area has been protected, however, sandal has been found to flourish remarkably and each existing tree has now been entered on the stock map. The students perform the nursery work and also that in the compartments of what may be termed the demonstration area.

The course commences in August of each year, and consists of two years, about half the period of training in each year being spent in the College and half out in camp on the practical courses. The fees charged per student are the same as at Dehra, i.e. Rs.1500 per annum. Costs have greatly increased since the war, but it has not been deemed advisable to raise the annual fee, which is the one charged for August, 1923. It was notified (Madras Government letter, No. 52—1/22—7, dated 7th March, 1923) to all the Governments outside the Madras Presidency who might wish to send probationers, that "in addition to the fees mentioned above the expenses of training at the College which will have to be borne by the Governments concerned come to Rs.1980 for each student for the whole course. The fee of Rs.1500, I may mention, does not represent the cost to this Government of the training of each student,

which at present works out to at least Rs.2050 per annum." Owing to the retrenchment schemes in force at this time the number of prospective Rangers for training for Madras itself had been reduced to four, and anxiety was felt on the score of the College, the question of closing it down even being mentioned. When it is remembered that the Ranger is the backbone of the Divisional Forest Officer and that the trained Ranger is essential if the present progress is to be maintained and enhanced the possibility of curtailing the education of this grade of Forest Officer is to be regretted. For the great Indian States with important forest interests to conserve the training of their Ranger Staff is also of vital importance. The writer was much impressed with the efficiency of the College when shown round by the Director, Mr. C. R. F. Williams, M.C., in 1925.

A Ranger's Forest School was started in Burma years ago, as the Burmans would not go to Dehra Dun. It was first at Tharrawaddy and subsequently transferred to Pyinmana in 1910. There is an English course for Rangers and a vernacular course for Deputy Rangers. The courses are two-year ones. The School has a fine building and is under a Director and Instructors drawn from the Imperial and Provincial Forest Services. There is a Board of Control consisting of the Chief Conservator, two Conservators, the Director and co-opted Examiners.

4. THE FORESTER AND FOREST GUARDS' COURSES

Nearly all the Provinces now make some attempt to give elementary training to the better men amongst their Forest Guards. This usually takes the form of a few weeks' training during the monsoon months, when work in the forests is at its lowest. Some have a more elaborate training in the vernacular given to Foresters and Deputy Rangers. The Forestry Heads of the Provinces record the following remarks on this subject :

United Provinces.—Clutterbuck started a Provincial Training Class for Forest Guards at Ramnagar. As a result, the Guards completing the course satisfactorily were promoted to Foresters and Deputy Rangers, so it really became a training centre for promotion. About 1922 it was split up into three Circle Classes, with no particular headquarters. In 1925 the classes were in abeyance.

Punjab.—The Punjab Forest School has proved very useful in training the staff which would not otherwise be of any use, except for protective purposes. Every year about twelve men are trained in the School, including some three or four men

from the Native States, who also greatly benefit by the existence of the School.

Bengal.—The standard of instruction given at the Bengal Forest School at Kurseong has been gradually raised and the training has increased the efficiency of the subordinate staff to such an extent that eighteen of them have attained the rank of Ranger, while one, who passed out of the school in 1907, has been promoted to the Provincial Service. The Museum of Forest Products and the Herbarium have been added to (Quin. Rep., 1919-24). It will be apparent that this School is something more than elementary classes for Forest Guards. In fact English-speaking Deputy Rangers and Foresters are sent to the School from Bihar and Orissa.

Assam.—There is no class for training Forest Guards.

Central Provinces.—The Forest School is situated at Balaghat. This is an old institution. A one-year's course is given in the vernacular to Foresters and Forest Guards. The present policy (1925) is to send better educated outsiders to the School. If they pass they can then enter the Service as Deputy Rangers (a rank abolished in several Provinces) on Rs.40 per annum.

Bihar and Orissa.—Has no School. Hindi-speaking Forest Guards and Foresters are sent to the Balaghat School and Uryia-speaking ones to the School at Russelkonda in Madras.

Burma.—There does not appear to be any instructional centre for the education of the Forest Guards.

Madras.—A vernacular School for the training of Guards is held in different Divisions of each Circle annually in the rains, the course being a six-months' one. Originally Foresters used to attend this course, but they now, if selected, go to the Forest College at Coimbatore.

Bombay.—A class is held during certain months of the year in the Northern Circle (Vada) for giving practical training to Foresters and Guards of the Northern and Central Circles.

CHAPTER XIV

THE INAUGURATION OF THE FOREST RESEARCH INSTITUTE AND THE PROGRESS IN FOREST RESEARCH WORK, 1906-25

THE small beginnings of research work which had been undertaken by officers of the Department up to the end of the last century have been alluded to in a previous chapter (II, Chap. XX). That so little had been accomplished in this important branch of the activities of a Forest Department must be attributed to the obsession for revenue making, which had animated the various Governments.

In the early days the Department had to justify its existence by at least producing a revenue which would cover the costs of the new administration ; but, as has been shown, even in this respect there were instances in which both the Secretary of State and the Government of India had pointed out that it was not possible to expect the Department to pay its way in cases where the management had taken over forests ruined by excessive exploitation before they came under its charge. Even Brandis, when he was given the opportunity of laying down the correct lines of future Forest administration in the Madras Presidency, stated that for a considerable period the Department would be faced with a very heavy expenditure, the price to be paid for the previous delay and neglect in introducing a correct management (*vide* p. 21 *ante*). Nevertheless, in its early days the policy enunciated, that the Department should endeavour to at least pay its way, was theoretically sound as it was but repeating the practice which had been followed in Europe after the introduction of a scientific conservancy of the forests. It has been shown that the new Department was greatly assisted in its infancy by the fortunate conjunction of the great expansion in railway construction which synchronized with its first formation. Both harm and good resulted. Fine forests were ruined by ignorant over-exploitation, as in the Central Provinces and elsewhere, and extensive areas of private forests disappeared ; but, on the

other hand, great untapped forests were opened out and, though unavoidable mistakes were made, the fellings were carried out as systematically as was practicable when the smallness of the staff or the Department and the want of scientific training of its officers are taken into account. To these fortunate circumstances, to the amazingly rapid progress of the people in prosperity under ordered British rule and the almost perfect administration of the Indian Civil Service, to the extension of the area under cultivation and in cattle and flocks, with the consequent increased demand for forest produce, must be attributed the indisputably rapid success with which the new Department made its way and assumed its position as one of the administrative units of the Government. But this very success had its drawbacks. The Department came to be regarded by the Heads of the Civil Administration and by its own Chiefs as a purely commercial concern—its chief *raison d'être* the production of revenue. Through all the Despatches, Proceedings, Memoranda and Reports written during the last quarter of the past century runs this strong undercurrent—that the Department was primarily maintained for the production of revenue. Brandis himself, as his Reports well show, though his first preoccupation was to produce or endeavour to produce a good balance-sheet, constantly reiterated the necessity of undertaking research work in silviculture and the economics of the forests. But in his day, although a great deal of energy was expended in the attempt to form plantations at the expense of progress in demarcating the forest boundaries and the necessary silvicultural attention to the impoverished growing stock, the staff was far too small and inadequately trained to undertake research work. But Brandis laid the foundation of a trained staff and by the end of the century there were few of the old untrained officers left in the Department. Yet the energies of the trained men were absorbed in revenue making. It had come to be regarded as the chief object ; the Reviews of the Civil Administration on the Provincial Annual Forest Reports were favourable or otherwise in accordance with the nature of the balance-sheet ; and but a small percentage of the officers had ever had an opportunity of putting into practice the elaborate training they had received in their professional work. The Department was stagnating. The scientific training of its officers was not being utilized to the full, the capabilities of the forests were very far from being understood, because they had not been

scientifically studied. For the trained officer, however great his leanings towards the scientific study his charge offered him, was immersed the year round in revenue production ; and the progress of the revenue itself with the gradual felling of the old marketable growing stock of the accessible primeval forests was threatened with inevitable stagnation, if not with a serious decrease. In spite of all deterrents there were in the Department, be it said to their credit, some botanists who had achieved a European reputation and there were others on the staff who, as will be shown, were quite ready to take an opportunity offered them of showing that its officers were capable of playing a higher rôle than that of the timber merchant or purely estate agent. But the opportunity for giving scope to, and of making use of, the talent existing had to be made and the man arose to open a new chapter in the history of the Department.

It has been mentioned (II, p. 611) that a temporary appointment of Forest Entomologist was proposed by Ribbentrop and sanctioned by the Government of India in 1900, just before the former's retirement from the Service. The history of this temporary appointment proves to the hilt the prevailing ideas of the Authorities on the objects for which the Department was maintained. The writer took up the appointment of Forest Entomologist at the close of 1900, the late Mr. H. C. Hill, C.I.E., being then Inspector-General. It is impossible to say that Hill was in sympathy with scientific research. Sylviculture in its aspects bearing on Working Plans and revenue were perhaps his chief preoccupations. The entomology of the Indian Forests was practically a closed book, the difficulties of obtaining identification of the commonest of the pests which the briefest study showed might be of importance as a possible source of future danger were great, in the absence of collections in India ; added to which it was quickly discovered that many were new to science. These points need not be insisted upon ; they will be obvious to the scientific man. Yet before the first year of the appointment was out the writer was told (quite in good faith as he can asseverate) that he must produce published papers or otherwise he would be regarded as wasting his time. The position was one of extraordinary difficulty for a junior officer animated with the conviction that this was a commencement of real research work in the Department by one of its trained officers specially deputed for the purpose, and that his failure to justify the new departure would of necessity convince

the Government that research work in the Forest Department was a waste of money, as their Inspector-General, who had their full confidence as a very fine Forest Administrator, evidently considered it to be. Mr. Hill went home on furlough in April, 1901, and died suddenly in England on the eve of his return. Mr. R. C. Wroughton from Bombay had been appointed to officiate as Inspector-General. Wroughton was a scientific man of some considerable ability. He had studied during his service several branches of zoology and had collected for the Natural History Museum in London and the Bombay Natural History Society, of which he was a strong and valued supporter. But in spite of his predilection for science, Wroughton was unable to obtain the prolongation of the post of Forest Entomologist. It had been made for two years and in face of Hill's openly expressed scepticism as to its value it was to be dropped for the time being. The writer took furlough, but before he had left the country was offered and accepted the officiating post (temporarily vacant) of Superintendent of the Indian Museum, Calcutta. This was early in 1903. Wroughton had proceeded to England on furlough preparatory to retirement, and Eardley Wilmot had been appointed Inspector-General of Forests. In Calcutta on his arrival from Burma he learnt from the writer the position of affairs as regards the post of Forest Entomologist.

A new phase in the history of the Department was to open with Eardley Wilmot's appointment, a phase whose far-reaching results can, at the present moment, only be dimly envisaged; but the extraordinary progress achieved in the small period of two decades as the outcome of the steps he now proceeded to take, leave in no doubt the great value of research, employing the term in its widest sense, when intelligently carried out by the trained Forest Expert for the improvement and more efficient administration of a Forest Estate.

Eardley Wilmot laid no claim to be a scientist. That he was a sylviculturist of no mean order in his day the monographs he published on some of the Northern Indian species go to prove (II, p. 604). But if he laid no claim to be a scientist he was a great administrator and a man who had maintained through his years of service the wide vision of the real position which the trained Forest Officer should occupy in a Department. He had for some time been convinced that the inauguration of research work in connection with the Forests of India was an urgent necessity. Holding these views, it is scarcely necessary

to say that one of his first actions as Inspector-General was to review the question of the reappointment of a Forest Entomologist and obtain the Government of India's sanction to the post. This was but a first step in a much wider project.

In 1901 the Viceroy (Lord Curzon) had sanctioned the formation of an Agricultural Research Institute. This Institute came into being at Pusa in Bihar. In so far as this precedent existed Eardley Wilmot was fortunate. But he was equally fortunate in the presence of a great and far-seeing statesman in the person of Lord Curzon, a man to whom no scheme was either too big in its inception or its intricacies too difficult to master. In fact numberless stories were current at the period in which the expert explaining his own work to the Viceroy was puzzled as to the answers to give to some shrewd questions put by the latter.

Eardley Wilmot, after careful discussion of the matter with his senior officers, formulated a scheme under which a Forest Research Institute should be inaugurated at Dehra Dun to which would be attached a staff of specialists working at investigations in different branches of forestry science, the Institute to be under the Government of India and its expenses to be defrayed from the Forest Budget. The most important part of the Inspector-General's proposals, and the one which gave the liveliest satisfaction to the Viceroy and his Council, was Eardley Wilmot's claim that the Institute could be staffed from the Controlling ranks of the Department. That, in other words, he had faith in the scientific training and attainments of his officers and that he was fully confident that he would be able to select men to fill the posts to be made. The Government of India had had to obtain experts from home to fill the research posts at the Agricultural Research Institute at Pusa. Consequently their pleasure at hearing that they had in their own Department in India men who would be able to fill the posts in the new Forest Research Institute may be readily understood.

Acknowledgments must be made to an Inspector-General who was prepared to risk his own reputation and with it the future progress of the Department entrusted to his charge on his opinion of the scientific abilities of its officers, given that they were granted an opportunity for displaying them. That his great faith and his courage in giving it play were justified to a remarkable degree results have shown, and he has the great satisfaction of witnessing the success of his policy.

The proposals for the formation of a Forest Research Institute were considered and formulated between 1903-5 and in 1906 the Imperial Forest Research Institute was established. Its objects were officially stated as follows: "In order to make better provision for scientific research in connection with the Indian Forests and to give the best available training to candidates for the Forest Services both of British India and Native States, the Government of India, with the approval of the Secretary of State in 1906, raised the status of the then Forest School, Dehra Dun, to that of Imperial Forest Research Institute and College, Dehra Dun." The Secretary of State was Lord Morley and his Despatch (Rev. No. 61, dated March 23rd, 1906) sanctioning the Research Institute marked the greatest epoch in the history of the Department since its formation. The Inspector-General of Forests was the first President of the Institute. The Research posts were six in number and the appointments made in 1906-7 were as follows: (1) Imperial Sylviculturists (Hobart Hampden, 1906, and J. H. Lace, 1906-7), who were also Principals of the College; (2) Imperial Superintendent of Forest Working Plans (A. M. F. Caccia); (3) Imperial Forest Zoologist (E. P. Stebbing); (4) Imperial Forest Botanist (R. S. Hole); (5) Imperial Forest Economist (R. S. Troup); and (6) Imperial Forest Chemist (Puran Singh, appointed in 1907-8). As has been shown in the previous chapter, these officers, the first five of whom belonged to the Imperial Forest Service, were to lecture in the Forest College and supervise portions of the practical courses in the field, the College Instructors being all drawn from the Provincial Service. In practice it was found, as the research work began to develop, that the Research Officers had to give too much time to the educational work, and in 1912, when a separate course of studies for the Provincial Service was inaugurated, Instructors from the Imperial Forest Service were appointed for the latter course and others for the Rangers' Course, as had been the case previous to 1906 [Sec. of State (Lord Haldane), Despatch No. 8, Rev., dated 19th January, 1912]. At the time of the creation of the Institute the only available accommodation, and this was scanty, was in the College building itself, the College Museums forming the nucleus of the Institute's collections. The exception was in the case of the Forest Zoologist. This post, under the designation of Forest Entomologist, had been in existence for some four years, and separate accommodation outside the College

had been provided for him in 1904, previous to which date he had a room within the College building. This latter was now called upon to find room for the Sylviculturist, Economist and Forest Chemist until suitable buildings could be erected. The Forest Botanist was the luckiest of the newly appointed officers as he was provided with, for that time, palatial accommodation in the building which had been occupied by the Forest Surveys, where the Working Plans Officer was also housed.

The question of providing suitable buildings for the new Institute was taken up and the first plans were drawn with the idea of their erection in the small area of land available in the College grounds. Mr. Lace having proceeded on furlough in 1908, Mr. L. Mercer was appointed President of the College (instead of this post being held by the Inspector-General of Forests) and the posts of Sylviculturist and Working Plans were combined and held by Caccia. Mercer advocated the College ground site, and the proposal was accepted by the Government of India. Mercer proceeded on leave in April, 1909, and Caccia officiated as President. The Research Staff, holding the opinion that the College ground site was altogether inadequate in area to permit of sufficient accommodation being provided, a letter to this effect was drafted and placed before the officiating President. The receipt of this letter by the Inspector-General, Beadon-Bryant, resulted in a reconsideration of the matter, and eventually the Chandbagh site, on which was situated the building already occupied by the Botany Branch, together with a neighbouring estate, a total area of 47 acres, was acquired at a cost of Rs.1,68,000. That the action of the Research Officers was a shrewd forecast of their then requirements is proved by the fact that the spacious accommodation erected on the Chandbagh area was found by 1918 all too small to cope with the extraordinary rapid progress made by the Institute. The fine block of buildings erected on the Chandbagh site at a cost of Rs.5,08,000 was opened in 1914, and provided accommodation for the Sylviculturist, Economist, Forest Zoologist and Forest Chemist. The main block contained extensive museums, offices, classrooms, etc., and was surrounded by ample laboratories and workshops fully equipped for the conduct of the research work which had by then made considerable progress, as will be related under the different branches later on. It was due to the strong support of Sir Robert Carlisle, Revenue Member in 1913, that the money was made available.

At the time the new Institute was opened it was believed that the accommodation would be sufficient, without further expansion, for at least twenty years. The Great War, however, resulted in considerable calls being made upon the Research Staff and gave an impetus to the utilization of some of the timbers of the Indian Forests other than the few species in common use. The War years proved that the recently built Institute had already outgrown its capacity if Forest Research was not to be checked in its great advance. The Government of India had become fully alive to this remarkable development, and recognized their indebtedness to the work carried out by the Institute during the War, and in 1918 schemes were considered with the object of developing the existing Institute. The schemes were generally accepted and approved early in 1919 at the Triennial Conference of Conservators from all Provinces of British India. The first idea was to expand the Institute by taking up more of the adjoining land. On further consideration, and with the lessons learnt from the 1914 scheme, it was finally decided to erect a new Institute on a site some four miles outside the Dehra Dun station and to utilize the existing buildings for educational purposes, in the event of their being so required. Since the new scheme also involved a considerable addition to the staff of the Institute it will be necessary to deal with the proposals in some detail. The Department again found powerful support at headquarters in the person of Sir Claude Hill.

In a Government of India Despatch (Fin. Dep. No. 495, dated 12th December, 1919) to the Secretary of State (Mr. E. Montagu), a comprehensive scheme for the suggested expansion was dealt with. The Despatch commences by stating that results of practical value are of necessity slow of attainment in dealing with forest crops; nevertheless a substantial foundation had been laid and creditable results had been obtained both in the scientific and applied branches. The Government of India, invoking the aid of the Report of the Industrial Commission which had sat in India, continued: "We have long recognized the limitations of the Institute and been convinced of the necessity of expansion" (it will be remembered that the new buildings had only been in use for five years, which of itself furnishes a remarkable instance of the deep impression which the work carried out had made upon the Government of India), "and we have been strengthened in this conviction by the Report of the Industrial Commission

which lays special stress on the necessity for its development in order to meet the rapidly increasing demands of the country. In paragraph 63 of that Report the equipment of the Institute is described as wholly insufficient, and the necessity for increasing the number of Research Officers is pointed out. The requirements of forest education are also hampered by the limited accommodation at present available, and extension in this direction is also necessary. It has not been possible during the War to provide the necessary laboratory equipment and staff, but in view of the rapid developments that have recently taken place in the utilization of the forest resources of the Indian Empire, all tending towards rendering the country less dependent upon foreign sources of supply—and the unique opportunities, which now present themselves, of developing forest industries and of finding uses for hitherto little-known products, we consider it of special importance that action should be taken without further loss of time to make provision for present and future requirements. Large commercial and industrial interests are involved: the State Forests cover 251,512 square miles, the net revenues have risen from 74 lakhs in 1892-3 to Rs.150 lakhs in 1912-13 and to 210 lakhs in 1917-18, and we consider that these increases, large as they are, are capable of very great expansion. Our expenditure on research and education during 1917-18 amounted to less than 1 per cent of the surplus. This appears to us to be wholly inadequate; the greater part of our forest properties are undeveloped, and we have no hesitation, therefore, in putting forward proposals which will permit of the functions of the Institute being more correctly proportioned to the importance of the issues at stake."

In the light of the above-expressed opinions a perusal of the Despatch of the Governor-General in Council, dated 1st November, 1862 (*vide* I, pp. 522-30), will clearly indicate the important position which the Department had won for itself in the Administration of the country by 1919. Something over half a century had elapsed and yet so incalculable is the potential value of the great Forest Estate in India that we find the Government of India writing in 1919 that "the greater part of our Forest properties are undeveloped," an opinion which the modern-day Forest Officer in India will have little hesitation in endorsing. The Despatch continues: "We have considered the possibility of decentralizing Forest Research and have consulted Local Governments in this matter. In

connection with the Function Committee's Report the necessity of maintaining Research Institutes under the Central Government has been accepted, and though Local Governments, generally, have urged the acceptance of the principle that in matters of special and local interest they should be free to provide for and carry out research, there is unanimity of opinion as to the necessity for a central institution to deal with the more strictly scientific portion of research for the general guidance and co-ordination of investigations, and for the collation and distribution of information and the publication of results. We are completely in agreement with this view which is in the interest of rapid development, and follows, we understand, the practice in the United States."

The Despatch then deals with the proposed augmentation of the staff. The original main Divisions of the Research Institute, excluding Working Plans, which had been retransferred to the Inspector-General's Office, were to be maintained, i.e. Sylvicultural, Botanical, Zoological, Economic and Chemical branches, and each was to be subdivided into a number of sections manned by experts under the general control of the head of each branch. Since under Article 20A of the Forest Department Code (7th Ed.) some of the latter might attain the rank of Conservator, it was proposed to raise the rank of the President of the Institute to that of Chief Conservator. The latter would be assisted in the management of the Institute by a Council composed of the heads of the various branches. A Personal Assistant, who would be an Imperial Officer, was also to be given to the President to assist with the Forest publications and other work as soon as an officer was available. The Despatch then details for each branch the suggested additional staff. At the time the Sylviculturist, Botanist and Zoologist had each two Assistants, the Chemist, an Assistant Forest Chemist and one Assistant, while the Economist had an Assistant Economist (an Imperial Officer), a Tan Expert and a Cellulose Expert (Mr. Raitt). The new proposals involved the following additions: two Imperial Service Officers as Assistant Sylviculturists; one Systematic Botanist (I.S.O.), one Special Officer, at the time shown as I.S.O., and one Assistant to the Botanical Branch; four Imperial Forest Officers, to act as Regional Zoologists, and three Assistants to the Zoological Branch; one Biological Chemist on pay similar to that of an I.S.O., one Distillation Chemist and one Assistant, the reorganization of this branch involving a change

of salary of the Forest Chemist and the addition of one Imperial Forest Officer ; in the Economist Branch, the branch which had perhaps had the greatest opportunity of impressing on the Government the great benefits to be derived from co-ordinated research and possessed the largest staff, the additions proposed were two Imperial Service Officers, two experts for five years (Pulp and Tan) and two officers on temporary establishment. The Imperial Service Officers were to hold the appointments of Wood Technologist and Minor Forest Produce, the temporary establishment posts were to be filled by an Engineer Mechanic and an Expert Wood Worker. It was proposed to increase the rates of duty or extra allowances drawn by the Research Staff "in order to attract the best officers to the Research Institute and in view of the fact that their responsibilities will be increased."

The Despatch continued : "The above proposals involve an increase in the number of Imperial Forest Service Officers employed at the Institute from six to eleven and eventually perhaps fifteen, if it is found possible to obtain officers with the required training to undertake the duties of the Regional Zoologists. The Mycologist, the three Chemists, the Pulp and Tan Experts (temporary) will not be Forest Officers." The Indian Assistants were divided into upper and lower grades of pay, analogous to officers of the Provincial Service and Rangers.

"It will take some time," said the Government of India, "before the full cost of the proposed staff can be worked up to, but we anticipate that it will ultimately involve an annual expenditure of Rs.3,46,052. To this total cost must also be added about Rs.96,000 per annum on account of clerical, menial and miscellaneous establishments. Including all establishments the present annual cost is Rs.2,05,040 and the extra cost of the scheme may be put at Rs.2,40,000 a year in round figures."

The Government of India then dealt with the question of the buildings, etc., necessary for the proposed expansion of the Institute. On this subject their Despatch takes broad views, and makes proposals which the most sanguine of the Research Officers who were appointed in 1906-7 would have scarcely dared to entertain, much less have given voice to. We read : "Our proposals necessarily allow for the provision of adequate laboratory and workshop equipment. In your telegram of the 4th September, 1919, you have sanctioned the deputation of Mr. Raitt, our Cellulose Expert, to England with a view to

obtaining special plant for the investigation of the problem of utilizing the enormous quantities of grass, bamboos and other materials available for the manufacture of paper pulp. In our telegram of the 9th September, 1919, we also asked your sanction to the deputation of Mr. R. S. Pearson, Forest Economist, in interruption of his leave, to procure laboratory and workshop equipment from America and England. We estimate the total cost of our requirements for the above equipment, including the necessary buildings, at Rs.4,00,000, and whatever your decision may be on our proposals regarding the large scheme of expansion, the plant is urgently necessary for research that is possible under existing conditions; we have therefore made a grant of Rs.3,00,000, to be utilized during the current financial year for this purpose. In connection with the necessity for expansion and the best means to be adopted to give effect to it, it has been brought to our notice, and emphasized by the Board of Forestry at its triennial meeting in March last, that the existing site is inadequate for immediate requirements and will allow of inadequate expansion in future. The existing estate covers 47·8 acres and provides accommodation for the main research building, laboratories, small workshops, three residences, a hostel and a playing-field for students. It would be possible to acquire an area of 29·7 acres adjacent to the present site, but there is no possibility of further extension in this locality. Difficulty is already experienced in housing the existing staff, as Dehra Dun is a rapidly growing town and an important cantonment in which house accommodation is below requirements. We have therefore been forced to consider the provision of house accommodation as part of the scheme of expansion. We are also faced with the necessity of providing accommodation for the increasing number of Provincial Service students. But even if it were possible to erect the buildings, now required for research and residential purposes, on an area of a 77·5 acres and also to improve a water supply which it is stated would be insufficient for the increased staff and work connected with it, we should still have no room for future expansion and no provision could be made for those experimental and demonstration areas which we consider of special importance in connection with an Institute depending so largely on field work for its results, both in education and research. The transfer of the Research Institute to a more central locality was discussed by the last Board of Forestry and

has received our consideration, but no better centre can be found. Dehra Dun offers certain climatic and other advantages for educational, research and practical work both in the plains and the hills, while we consider it advisable to continue the traditions already established there as the main centre of our scientific and educational activities in forest work. We have accordingly decided to retain the Research Institute at Dehra Dun and have, after very careful consideration, selected a site of about 1200 acres, at a distance of four miles from the town, with a view to providing, in addition to the requirements of the main buildings, workshops and residences, ample space for the necessary field work and for the future expansion of staff and equipment which we feel certain will take place. The cost of acquisition of the land for the new site is estimated at Rs.4,80,000. Although we have not recommended in our Despatch, No. 368, dated the 11th September, 1919, the training in India of recruits for the Imperial Forest Service, we contemplate that this may ultimately be desirable, and if this proves to be the case we shall no doubt be able to find room for it on the site we propose to acquire, instead of having to purchase land at an enhanced price as would undoubtedly be the case if we extended later. . . . In order to prevent any fictitious enhancement of the value of the site that we wish to acquire we have already issued the necessary preliminary notification : this action, while affording the protection we require, will not bind us to acquisition in the event of your not being prepared to accord your approval."

The Despatch then summarizes the cost as follows : " The total outlay on the acquisition of a new site, the erection of the necessary buildings and the provision of workshop and laboratory equipment is estimated at approximately Rs.30,58,000." This estimate proved to be below the actual expenditure.

" This sum represents only about one-seventh of the net revenue of the Indian Forests for the year 1917-18. We do not consider the amount by any means excessive, and believe that it will be money well spent in expediting the development of our vast Forest resources. As we are anxious to proceed with the acquisition of the land and to erect on it, instead of on the old site, the buildings for the plant which is in any case necessary, and as we wish to be able to spend in the current financial year such sum as we may be able to allot, we would ask you to telegraph your sanction to the expenditure on the

first item stated in the preceding paragraph, namely, the acquisition of the land required."

The Secretary of State (Montagu) telegraphed (25th February, 1920) as follows: "I sanction your proposals. Question is still under consideration, but I shall probably decide to train all Imperial Service probationers at Dehra Dun; this will necessitate additional expenditure on staff and buildings; but I do not delay sanction on this account, as supplementary estimate can, if necessary, be submitted."

A year later the Government of India addressed a further Despatch (R. and A. Forests, No. 29, dated 16th December, 1920), on the subject of the augmentation of the staff proposals contained in their December, 1919, Despatch. During the year some correspondence had passed between the Government of India and the Secretary of State on the subject of recruiting a Wood Preservation Specialist and an Expert Wood Worker. Pearson had also returned from his tour in America and had pressed for certain further additions to the Economist's Staff. His representations were successful; for in their December, 1920, Despatch the Government of India, after stating: "We attach special importance to the augmentation of this branch, as on its activities the development of our forest resources and revenues largely depends," continue as follows: "Our proposals provide for the appointment of Assistants to the Officers in Charge of Technology, Seasoning and Timber Testing, who, after undergoing the specialized training to which we refer in a subsequent paragraph and after working for a short time at Dehra Dun under the temporarily engaged experts employed to inaugurate the sections, will be in a position to take over the duties of the heads of these sections when the engagements of the experts terminate. This will, we feel, be a more satisfactory method by which to staff these posts permanently than that of filling them by selected Forest Officers after a special course of training, a course which we had first contemplated. The cost will be no greater, and there appears to be no reason why the officers filling these posts should be trained in Forestry." The latter argument may or may not be sound, but the former is open to the objection that if put into practice it would seem to gravely imperil the value of the Economic Branch itself. Can the hope be seriously entertained that competent business men would have sufficient confidence in Heads of Sections who, after undergoing a specialized training of a year or so and *after working for a short*

time at Dehra Dun under the temporarily engaged experts employed to inaugurate the sections, were then considered to have sufficient experience to advise on commercial undertakings. No business man would risk his money on the advice of men who had had no practical experience beyond that of a student of the subject in the sections of which they were so quickly promoted as heads. The Economic Section has made its name by being fortunate in having at its head almost from the start a man with the aptitude and energy of Pearson, who had on his staff experts of European or world fame to work out the problems connected with the utilization of certain materials, e.g. paper pulp, tans, etc. To imagine that such experts after a few years can be replaced by juniors with little more than a theoretical training is a reversion to the old idea that the specialist is easily made and research work equally easily carried out. For Indian Forestry the Dehra Institute has disproved both these fallacies. The Government of India stated that they desired to recruit these Assistants in India provided that suitable candidates, Indians, Anglo-Indians or Europeans, domiciled or otherwise, could be found who possessed the same or equivalent qualifications to those prescribed in the regulations for the recruitment of Forest Engineers. It was proposed that the Assistants to the Seasoning and Timber Testing Specialists and Wood Technologist should be trained in their respective subjects in America before taking up their duties; the first named spending nine months, the second nine months (four of which were to be at Montreal) and the third fifteen months. The Despatch continued: "It is intended that these Assistants should eventually take over permanent charge of the Specialists' work when the latter's engagement terminate and it is therefore important that before joining in India they should study the most up-to-date systems and methods of work in the country where those systems and methods are best established. We do not think it would be possible to train these young officers properly at Dehra Dun as the work of the branches concerned will be only in its infancy, and even under the Specialists to be employed temporarily would afford comparatively poor training."

The Despatch finally asks the Secretary of State to arrange for the recruitment for the posts of a Mycologist, Botanist, Biological Chemist and a European Carpenter to be in charge of the Wood Workshops, the first two of which posts he had

already sanctioned. "The Mycological Botanist, who will be paid on the same scale as obtains in the Imperial Forest Service, may be allowed to enter that scale at such stage as you may deem desirable, while the Biological Chemist and Carpenter may be offered such terms as are found necessary." Unfortunately the post of Mycologist has not yet (1925) been filled. The Despatch ends as follows: "We are unable to provide during the current financial year funds for the pay of all the additional officers. Moreover, it will be difficult to accommodate them at Dehra Dun until some progress has been made towards the construction of new quarters, etc. We, therefore, desire that none of the men to be recruited in England, other than the Wood Preservation Specialist and Expert Wood Worker, should arrive in India before the 15th October, 1921."

The Despatch sets forth the sanctioned and proposed staff of the Economic Branch. The sanctioned consisted of ten posts: (1) Forest Economist, (2) Assistant Forest Economist, (3) Wood Technologist, (4) Minor Forest Produce Specialist, (5) Pulp, (6) Tan Specialist, (7) Engineer Mechanic, (8) Expert Wood Worker, (9) Seasoning Specialist, (10) Timber Testing Specialist. The increases proposed were Assistants to the Wood Technologist, Minor Forest Produce, Pulp, Tan, Seasoning Specialist, 2; Timber Testing Specialist, 3; a Wood Preservation Specialist and Assistant; an Assistant for the charge of the Veneer Cutting Section; an Assistant for the charge of Saw Mills; European Carpenter for charge of the Wood Work-shops; and an Assistant Electrical Engineer. In all twenty-five officers instead of ten, or an addition of fifteen officers.

In his telegram No. 999, of 15th February, 1921, the Secretary of State replied with the laconic sentence: "I sanction your proposal."

It will be apparent that the Economist Branch had thus been able to place itself in a strong position and one which it had fully deserved. But it was achieved to some extent at the expense of a branch every whit as important as that of the Economist, i.e. the Sylvicultural. The 1920 Despatch, in dealing with the Sylvicultural Branch, says: "In our Despatch No. 495, dated 12th December, 1919, we said that although research into Sylviculture would also be carried on in some Provinces, we considered that this branch for research and statistical purposes should be strengthened by the addition of two Imperial Service

Assistants. Since then the subject has engaged our further attention and we are now of opinion that decentralization in Sylvicultural research must be carried further than was formerly our intention. Practically all the experimental Sylvicultural work outside Dehra Dun itself and the treatment of sample plots for the compilation of growth and yield statistics must be done by local officers. The Sylviculturist at the Central Institute, who will be a fairly senior officer, will continue to advise local officers, coordinate work generally and manage the experimental gardens and demonstration areas attached to the Institute. He will require the two Indian Assistants already sanctioned, but the two Imperial Service Assistants are not likely to be wanted, and we propose to abolish these two posts." A saving of Rs.2354 per mensem was thus effected and the cost of the proposed increased staff for the Economist Branch was placed at Rs.6246 per mensem.

In an opening paragraph from the Despatch, already quoted above, the Government of India expressed the opinion : "We attach special importance to the augmentation of this (i.e. Economist) branch, as on its activities the development of our Forest resources and revenues largely depends." The sentence can be read in two ways—and the Sylviculturist certainly takes precedence of the Economist or Utilization Officer ; for it is the business of the former to develop or create those Forest resources which will be utilized by the Economist. The Economist Branch has played a wonderful part in the development of the Dehra Institute—but it will not be to the future interests of the Forest Estate if this development is allowed to proceed at the expense of the other branches of the Institute and above all of the Sylvicultural Branch, which has, it is fairly obvious, been starved. The chapter devoted to the Progress of Sylviculture during the period here under review will, it is believed, amply support this opinion.

After a perusal of the two Government of India Despatches, from which extracts have been quoted above, and their immediate sanction accorded by telegraphic despatch by the Secretary of State, the average man and the officers of the Institute and of the Department would have been justified in the belief that the future development and progress of this valuable work was assured. But events were to show that this belief was unfounded. The Indian Retrenchment Committee sat during 1922-3, and its Report, commonly known as the Inchcape Report, Lord Inchcape having been the President,

made some startling recommendations in connection with the future management of the Forest Department. On the subject of the Forest Research Institute the Report gives the expenditure on the Institute as follows: "1913-14, Rs.2,98,000; 1921-2, Rs.6,43,100; 1922-3, Rs.8,86,100; 1923-4, Rs.8,73,140. It then continues (the quotation has been already given elsewhere): "The activities of this Institute are twofold, firstly, research, and, secondly, the training of recruits for the Forest Services in India. We are informed that, on the educational side, the Institute is very largely self-supporting and, in any case, the development of this side of the activities of the Institute is, in our opinion, desirable. As regards research, a very costly scheme has been elaborated, the expenditure involved under the building programme alone amounting to no less than Rs.1½ crores. It has been brought to our notice that the extended activities proposed for the Institute include certain investigations which would more appropriately be left to private enterprise, and we consider that in any case it is not justifiable, in the present financial situation, to incur expenditure from public funds on research on this scale. We recommend that the whole scheme for the expansion of the Institute be reconsidered and that no further expenditure thereon be incurred beyond such amount as is obligatory in view of existing commitments. The establishment proposed for the Institute should also be reviewed, and we recommend that for the next three years it be limited to Rs.8 lakhs, saving Rs.86,000."

Comment is superfluous, since the opinions expressed by the Committee betray a total lack of appreciation of the work already achieved by the Institute and its enormous potential value to industry, to the Forest Department, and to the future revenue realizable from the Forest Estate.

Fortunately wiser councils prevailed and the Institute retained its grant, for the greater part, during the three years. But some posts such as the Minor Products Officer and the Mycologist remained unfilled, and these, as this history will show, are an urgent need.

The area of 1300 acres was acquired at a cost of Rs.12,82,000, and by 1925 the buildings and laboratories required by the Economist had been erected and the various sections, as will be described later, were in full work. One wing of the big Central Research Building was also going up. It is hoped that this great scheme in its entirety will be adhered to. There can

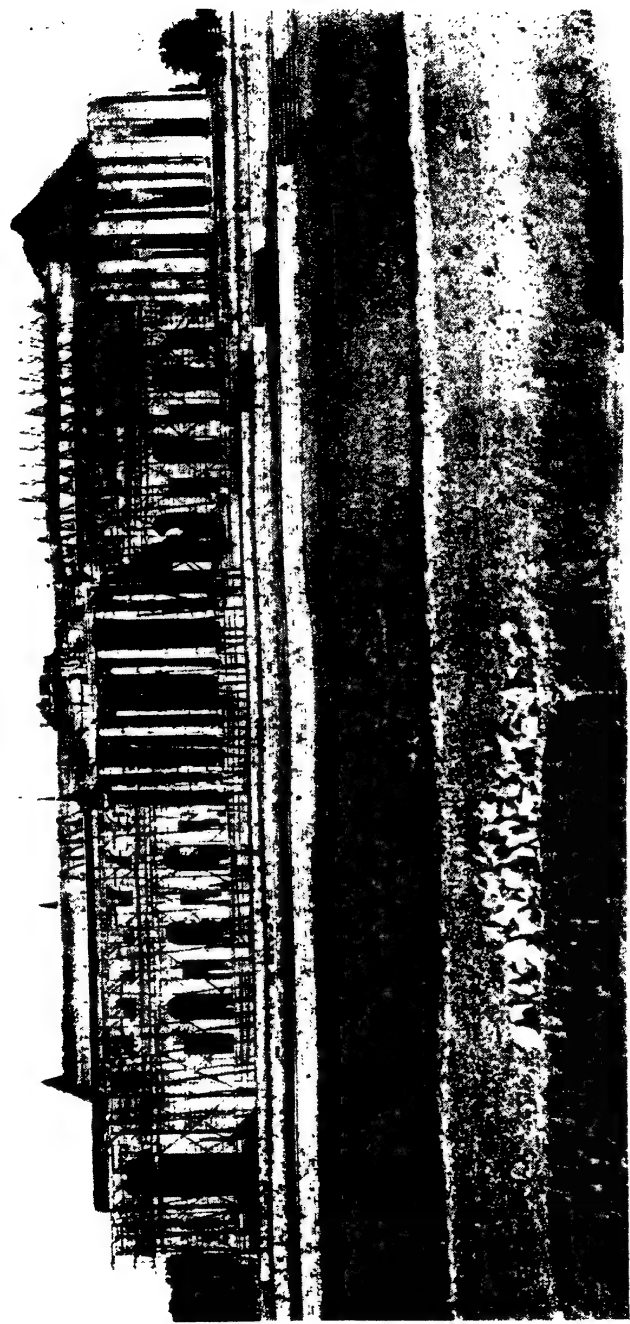
be little doubt that India will reap the full benefit, both financially and otherwise; whilst she will possess the finest Forest Research Institute in the world. During the past five years funds to the extent of Rs.63 lakhs have been made available. The successful outcome of this great scheme is chiefly due to the breadth of view of the able Finance Member, Sir Basil Blackett, and to the unremitting energy displayed by Clutterbuck and Perree, Inspector-General and President.

The opinion of Sir Clement Hindley, Chairman of the Railway Board, on the value of the Economists' Branch, has already been recorded in Chapter XII, p. 290 *ante*.

The General Administration of the Institute is under its President. Since its inauguration the following have held the post of President: Sir S. Eardley Wilmot, K.C.I.E., Inspector-General of Forests, 1906-8; Mr. L. Mercer, C.I.E., 1908-1916; Mr. B. B. Osmaston, C.I.E., 1916 to 1919; Mr. W. F. Perree, C.I.E., 1919 to 1925; Mr. A. Rodger, O.B.E., 1925 onwards.

The following officiated as President for short periods: Messrs. A. M. Caccia, 1909; R. S. Hole, C.I.E., 1913; R. C. Milward, 1920; W. Mayes, 1923.

One of the first steps taken after the inauguration of the Institute in 1906 was to consider the form in which the research work should be published. This matter was relegated by the Inspector-General of Forests, Eardley Wilmot, to the author. In consultation with the former it was decided to issue Forest Memoirs, Forest Records, Forest Bulletins, Pamphlets, and Leaflets (discontinued), the former two being modelled upon the publications issued by the Royal and Linnean Societies. The Memoirs were to be issued in separate series, one series being devoted to each Branch of the Institute and would be confined to monographs dealing with a piece of research in which the materials gathered were sufficient to enable a summary of scientific value to be compiled. The Records were to be issued in parts and would contain papers on particular lines of research which had reached a stage at which publication was desirable. These parts would be open to any Branch of the Institute and would be issued as material became available. The Bulletins were designed for the publication of papers dealing with research work which had reached a point where its commercial utilization was possible or when it could be used by the officers of the Department for protective work, silvicultural or other purposes. The pamphlets, were to be the medium for the issue of circulars devoted to the results,



MAIN BUILDING OF NEW FOREST RESEARCH INSTITUTE, DEHRA DUN, IN COURSE OF ERECTION. NOVEMBER, 1925



GENERAL VIEW OF THE ECONOMIC WORKSHOPS AND OFFICES AT THE NEW FOREST RESEARCH INSTITUTE, DEHRA DUN
NOVEMBER, 1925

Research Institute, photo.

written in simple language, of any one particular piece of research, viz. : on a species of tree and its timber and other qualities, the life history of a particular insect pest and possible remedies, and so forth. All the publications were to be illustrated, where such illustrations were of value to elucidate the text. The author was appointed the first Editor of the Forest Publications, a post he held from 1906 to the end of 1909, when he left India. The editorship has since been held by the President, who for a portion of the period has had the help of a Personal Assistant. The Indian Forest Publications are open to officers of the Department and to others who may wish to submit papers which in any way contribute to the advancement of Forestry knowledge in India. The work in connection with these publications is very heavy, and there can be little doubt that the President should be relieved of the burden which now (1925) falls entirely upon his shoulders.

It is impossible in this history to deal in any detail with the large number of memoirs, records, etc., which have been issued since 1907. Their nature can be ascertained from a perusal of the inside of the cover of any Number published, the detailed list being inscribed therein for reference. It may be mentioned that to date 14 Memoirs (in all Branches), 12 Volumes, including 76 Parts, of the Forest Records, Bulletins, O.S. 11, N.S. 67, and 16 Pamphlets have been published. Some Manuals, Lecture Notes and the Research Institute Projects have also been issued. It was at first feared that the Institute Publications might interfere with the *Indian Forester* (II, p. 602). This has not proved the case, the Magazine attaining its Jubilee in 1925.

Soon after the inauguration of the Institute it was decided that definite programmes of work should be drawn up for each Branch, laying down the lines of the research work which was to be taken up during the year or period of years. There is merit in such a step since it minimizes the danger of time being frittered away, of overlapping and so forth. There is always the danger, however, of the Research Officers becoming too stereotyped and falling into the official procedure of the ordinary Government office. Research should be left untrammelled so far as possible in order to be able to follow up a line whose existence was not previously surmised but whose study may lead to unsuspected developments. A hard and fast time table would endanger such a possibility and consequently interfere with real research work. It is not certain that the

great attention paid to the office work, ledger filing and so forth with which the Branches have been so occupied has not to some slight extent exerted this effect. That type of work at the outset of the establishment of a Research Institute has to be carried out—the point sought to be made is that the danger exists that it may become in the course of years a habit and come to be regarded as the chief function of the Research Officer. It is, of course, the duty of a President of such an Institute to see that true research work is not lost sight of in the ardour of ledger filing, or even amassing large collections, although the necessity of the latter is, of course, beyond dispute; for in their absence the Research Officer is helpless, as the pioneers at Dehra fully realized. At the risk of being misunderstood on these matters the author cannot free himself from the impression forced upon him during his study of the various branches of the Institute at Dehra this year (1925) that the danger does exist, even if no larger than a small cloud on the horizon, that research work may to some extent be made the servant, instead of the master, of the purely office routine work—that, in other words, the latter should be kept to the irreducible minimum. An adequate clerical staff, as also an adequate staff of laboratory assistants, should be provided for each Branch (the Economist and Chemist Branches are not primarily concerned here), thus freeing the purely Research Officers for their chief work, which lies out in the forests every whit as much as does that of the Divisional Forest Officer.

As has been mentioned, triennial programmes of work are prepared for each branch of the Institute. The lines of investigation are divided into groups and in each group the nature and objects of the particular item of research are detailed.

THE SYLVICULTURAL BRANCH, 1906–25

This post was held at the outset by the Principal of the College and subsequently by Caccia (Working Plans). No real commencement in sylvicultural research was made, however, until Mr. R. S. Troup was appointed to the branch in 1909. The duty of examining Working Plans was for some years still exercised by the Sylviculturist, but was eventually retransferred to the office of the Inspector-General. Up to the end of 1909 there was little that could be definitely called a programme of research work as at present understood at the Institute. Yearly programmes were drawn up and tours based

on these programmes were made. But of necessity the work was in its infancy and the pioneers were feeling their way. In fairness to those pioneers (and the statement may be made once for all) their successors and others should bear in mind that the first men inaugurated the research work and started it with nothing in the way of trained staff or an adequate staff, laboratories, etc., and yet the foundation their work laid must have been a sound one, or the mighty edifice now being superimposed would never have seen the light of day. The author had the pleasure of studying this branch in 1925 with Mr. S. Howard, its head, and the latter drew up a memorandum upon which the following is based. Alluding to the initial years Howard writes : " Tours were made in various parts of India, available data were collected connected both with sylviculture pure and simple and with rates of growth, out-turn, etc. The results were not obtained from careful experiment or measurement by Research Officers but were merely a compilation of available divisional data or the results of observations made on tour. On the other hand, it was this preliminary period which showed the necessity of properly organized research work, and more especially the necessity of standardizing methods of measurement and records for statistical purposes. In 1909 the Research Officer from Dehra Dun began for the first time to lay out sample or experimental plots, and then the branch at once started real research work. It may, therefore, be said that during the first period up to 1909, which corresponds with the tenure of Messrs. Hobart-Hampton, Lace and Caccia, the necessity of sylvicultural and statistical work was being realized and the scope of the branch was becoming defined.

Mr. Troup's tenure of the post from 1909 to 1915 marks another perfectly definite phase. At the commencement of this period he initiated the ledger files, collecting by species under suitable sub-heads all available information, whether it was the result of other people's work or his own research or observations. These ledger files have been continued almost unaltered to the present time. They have been abundantly useful and are the best method of filing such information which has so far been evolved, though certain modifications have had to be introduced recently. At the same time Mr. Troup commenced laying out sample plots for the compilation of yield tables. The first of these plots were laid out in the sâl forests of the U.P. as long ago as 1909. Various plots to test experimental sylviculture, methods of cutting bamboos, different

methods of natural regeneration, etc., were commenced. It must be remembered that at this time there was only one man in India to deal with both silvicultural problems and statistical matters. It is perfectly true that Divisional Forest Officers were doing excellent work themselves, but research work by Divisional Forest Officers is unfortunately seldom in such a form that it can be continued by another man, and, unless the Divisional Forest Officer is himself fortunate enough to bring his work to a conclusion, it too often happens that a transfer, a dose of fever or a spell of leave render whatever work he has done useless for the general community. The only office during this period where there was any continuity in research was in the Silvicultural Branch at Dehra Dun. Mr. Troup appears to have realized very quickly that if he waited to get results from his own experiments in many matters the Department would receive nothing for many years. He seems to have decided that the first and most important matter was to collect and place on record all available information from whatever source and, provided the conclusions from it appeared sound and logical, to adopt them rather than to wait an indefinite time to prove results by actual experiments." Troup concentrated therefore upon the ledger files, checking the information where possible whilst on tour, and relegated the collection of statistics from carefully measured permanent plots to a secondary position for the time being. He carried out experiments in the Silvicultural Gardens near Dehra Dun, devoting himself mainly to the seedling stage, germination and subsequent growth. The germinating stages of many Indian tree species were drawn and coloured in a series of magnificent plates, work which has been continued in the branch. Troup embodied the results of his own work and subsequent investigations in his great book *The Silviculture of Indian Trees*, published in 1922.

The next phase in the development of the branch is the period of Mr. Marsden's tenure, 1915-19. He turned his attention more to the statistical side. Marsden first collected together all data available on rates of growth and kindred matters from Divisional Records. In 1918 some of the Provinces were considering the question of appointing Provincial Silviculturists. An outcome of Marsden's work may be said to be the first Silvicultural Conference ever held which met at Dehra in 1918, at which methods of collecting future data were standardized. It regulated, says Howard,

" the methods by which in future data for regular yield tables should be collected in India, and these were published in Howard's *Code for the Collection and Tabulation of Statistical Data*. It also accepts as standard a classification of thinnings which appeared in the *Indian Forester* of February, 1916. In addition it laid down what it considered to be the main heads under which Working Plan control should be regulated. The Board of Forestry which met in 1919 accepted the standardized methods for collecting statistics. It referred the classification of thinnings to the Sylvicultural Conference for further consideration and it permitted the principles of Working Plan control suggested by the Sylvicultural Conference, but added certain matters concerning forest journals."

During the first two years of Howard's tenure, 1919 onwards, work was concentrated on introducing the new methods for the compilation of statistics and generally overhauling the whole of the statistical work in the Branch. Howard summarizes the work as follows : " Meanwhile various Provinces were either appointing or thinking of appointing local Sylviculturists and there arose the matter of subdividing the work. A large expansion of the Sylvicultural Branch had been proposed, but was unfortunately not carried out. It was becoming abundantly clear that the Central Institute was not able to conduct experiments on such sylvicultural problems as 'the natural regeneration of Deodar Forests.' The three yearly programmes which were set for the branch were often composed largely of vague items such as 'the sylviculture of the ever-green forests of Madras,' or 'the sylviculture of the chief species of Dipterocarps.' Any one of these items might have occupied a large staff of men for many years. The Sylviculturist from Dehra Dun was able to visit his plots only once every five years and sometimes not as often as that, and was quite unable to watch them closely enough to solve some of the intricate problems connected with natural regeneration in India. At the same time although the Central Institute was unable to attend to these large sylvicultural problems, it was becoming abundantly clear that most Provinces were quite unable to cope with their own statistical work. Practically no single Province had sufficient statistical work in hand to keep a staff of men continually employed, with the result that they were entirely unable to obtain the practice necessary to do this work properly.

In 1922 a second Sylvicultural Conference was called. This

Conference did even more important work than the first one. Perhaps its most important function was that it defined so far as possible the relations of work between the central and the local Sylviculturists. In future the local Sylviculturists were to look after all experimental silviculture except work in the seed and seedling stages, which was to be done by the Central Institute. On the statistical side the sample plots were to be laid out and measured by the local Sylviculturists, but all plots were to be sent to Dehra Dun for compilation. Other matters of statistical work were not specially allotted to anyone, but in actual practice statistical work is becoming more centralized. This Conference, among other matters, again put forward the classification of thinnings with one slight modification, and repeated its recommendations with regard to control both of which have now been accepted. At the same time it dealt with other matters such as definition of terms, classification of expenditure, record of plantations, annual research reports, etc."

The main part of Howard's work has been chiefly statistical. A yield table for sâl has been published which has been used in the United Provinces for the compilation of Working Plans. Other yield tables published or about to be published are for clear-felled sâl coppice, *chir* pine and deodar. In addition, volume tables for sâl on standard definitions have been published and local tables for commercial out-turn for the use of Divisional Officers, arranged by locality quality classes or by the length of marketable bole. Howard says that the staff of the branch is insufficient to pay proper attention to the other side of its work, the silvicultural, and this is abundantly apparent from the Annual Reports of the branch. He writes : "Till the staff has expanded it is impossible to take up this side (i.e. the silvicultural) without detriment to the other side, and as the work from the Provinces and statistics is now a regular feature it is impossible to close that."

The thought naturally arises in the mind of the Forester engaged in tuitional work as to the advisability of the Sylviculturist being burdened with the work of the Statistical Branch. Since the inauguration of the training of the Indian Forest Officer all of us have followed very much the same forestry courses. We know that there is a sharp dividing line between our silvicultural studies and those which deal with statistical work—mensuration, valuation and so forth. Only on the score of economy and the retransfer of the Working Plans branch to the office of the Inspector-General of

Forests can one account for the statistical work falling into the Sylvicultural Branch. The very meaning of the word sylviculture divorces it from any such close connection with the Statistical Branch as has come into being at Dehra Dun. It might be suggested that the Sylviculturist would, at the point research work has now reached at Dehra and in the Provinces, have more time to devote to his legitimate duties if the Statistical Branch, of equal importance in its own sphere, were entirely separated, as in fact it was when the Research Institute was founded in 1906. With the rapid increase of young crops under the concentrated methods of regeneration in force in many parts of the country it appeared to the writer that important practical investigations into the relative strengths of thinnings and so forth were an urgent need. The fine photographic section is attached to this branch.

THE ECONOMIC BRANCH, 1906-25

To the remarkable development of the Economic Branch perhaps more than any other, the Department owes the notoriety which the work of the Institute has achieved. A small brochure compiled on this branch entitled *The Development of India's Forest Resources* was issued in 1925. The object aimed at in drawing up this little work was to place before the public in non-technical language the nature of the work carried out and the objects aimed at. By the courtesy of Mr. A. Rodger, the President, and of the officers in charge of the various sections the author was enabled to make himself personally acquainted with the striking advances achieved in this branch of research. The following descriptions which, from considerations of space, have had to be abbreviated are chiefly based on the brochure. In an introduction Mr. W. F. Perree, C.I.E., the late President, correctly says that in a country like India it is impossible to measure the success of forest management entirely according to financial results. The uses of all forest produce are far from well known and there is scope for the creation of many new industries, all tending to replace imports and at the same time to find employment for indigenous enterprise, capital and labour. It is the aim and object of forest research to develop the resources of the country. The incidence of royalty on forest produce, he says, is usually a relatively small proportion of its market value, and in the case of products which have to be collected and transported at a heavy cost, perhaps manu-

factured by expensive machinery under costly supervision, the initial royalty or value of the raw material in the forest is relatively small. The benefit to the country arises in the money which changes hands in the process of handling, manufacture and marketing. This is the true criterion to the functions of a Forest Estate and its efficient management. There is endless scope for extension in the utilization of forest products in India.

"Three stages of research," says Perree, "are usually necessary. The first is the purely scientific enquiry, usually ending at the laboratory stage. The second involves an inventory in the forest to ensure the maintenance of supply of the raw material together with the manufacture, on a scale sufficient to test the market value and suitability of the materials or products in question. If this fails to establish a demand the third stage, comprising the erection of pioneer plants or factories will be necessary. The research now being carried out aims at covering the first and in certain directions, e.g. paper pulp, the second stage." The details which follow will show how far the objects above expressed have been achieved or are in process of achievement. Mr. R. S. Pearson, C.I.E., the Economist, gives the history of the branch to date. Troup, a Burma Forest Officer, was appointed Forest Economist in 1907. In 1909 he took over charge of the Sylvicultural Branch and was succeeded by R. S. Pearson, son of Colonel Pearson, who was the first Conservator of Forests in the Central Provinces and subsequently of the North-West Provinces (I, p. 393; II, p. 305). Pearson, with short intervals of leave, held the post up to 1925, and, backed up by the Presidents, Mercer, Ormaston and Perree, is responsible for its great success. At the period of the inauguration of this branch little had been done towards the utilization of the many products of the Indian Forests. The number of species of timber in common use throughout the country was small (cf. II, p. 510) and but a handful of the minor products had a marketable value. A valuable source of information on the timbers was available in Gamble's *Manual of Indian Timbers*, and the collection of specimens upon which it was based was available in the College at Dehra Dun. This was supplemented to some extent by articles which had appeared in the *Indian Forester*. Existing floras occasionally also referred to the uses of Indian timbers. As regards minor products, information was to be found in Gamble's *Manual*, Watt's *Dictionary of Economic Products*, Talbot's *List of Trees*

and Shrubs, etc., of the Bombay Presidency, and Kanjilal's *U.P. Flora*. In 1909 Watt's old post of Reporter on Economic Products (II, 608) was abolished and the records dealing with Forest Products, which had been collected by Sir George Watt and his successors, were transferred to the Economist at Dehra Dun. The College collections included a fair collection of minor products. The Economist started in the same position as the other branches, with little accommodation and no laboratory equipment. His staff, as in the case of his brother Research Officers, consisted of two Clerks and a Collector.

The first work undertaken in the branch was to classify the available literature and to start permanent Record Files. Later in 1909 the collections were taken in hand, added to, and a fair Minor Forest Products Museum arranged in one of the halls of the College. Space was not available in which to arrange a timber collection, and the best that could be done was to arrange Gamble's valuable collection in one of the verandahs. With the advent of the files of the Reporter on Economic Products the heavy task of sorting them out had to be taken up. For this purpose an Assistant Forest Economist was appointed and was employed for over eighteen months on the task.

The first enquiry undertaken was that on possible match woods. Owing to want of equipment the woods to be tested had to be sent to Europe. Troup issued the first Utilization Memoir on his investigations into this subject. In 1909 a very extensive enquiry into wood preservation was inaugurated, chiefly in connection with the important matter of sleeper woods, a subject it will be remembered which had cropped up as far back as 1864 (I, p. 508) and had long proved a difficult matter between the Railways and the Forest Department. This at once brought to a head the question of a laboratory or workshop. The value of research work had not yet become appreciated by Government and no money was available. The Economist faced the difficulty by appropriating an old wood shed in the grounds. This came in useful for heating the antiseptics with which the small specimens were treated. An enquiry into the utilization of bamboos for the manufacture of paper pulp followed, and this resulted in securing from home an expert, Mr. W. Raitt; the scope of the sleeper enquiry was developed and the question of more up-to-date methods of distilling essential oils, the development of *Boswellia serrata* gum-oleo-resin and many

other investigations were taken up. In the course of these enquiries a definite connection was established between the branch and local Forest Officers, the commercial world and the Railway engineers, and this connection was to lead to remarkable results. It had become recognized that the branch would have to be split up into several sections, but the time was not yet ripe. The absolute necessity for the expansion of the Research Institute had become apparent, and the new building opened in 1914 was the result. Of the accommodation available in this building, two large museums were allotted on the ground floor to the branch, one for timber specimens and the other for minor products. In the former Gamble's collection of timbers at last found a worthy, although as results were to show, not a final resting-place. The workshops of the branch erected round the main building consisted of a timber testing workshop, an experimental timber treating plant, working according to the open-tank method, and storage rooms. Later a small wood workshop and a seasoning kiln, of a temporary nature, were added. That the branch soon grew out of the accommodation so provided has been already detailed, as also the great conception which planned and built the new workshops which are in operation. As Pearson rightly states, the difficulties did not lie in the buildings, for money had now become available, but in purchasing the right type of machinery and the more difficult problem of securing the services of first-class specialists for each branch of the work. These could not be drawn from the Forest Department; rather had they to be sought in the ranks of commercialism. Two such Pearson had had on his staff, Mr. W. Raitt, a paper pulp expert of world-wide fame, and Mr. Pilgrim, a tan expert, who had returned home when the tan market disappeared. As we have seen, Pearson was deputed in 1920 to England, Canada and America to study the lines of similar work being carried out in those countries, whilst Mr. Raitt was deputed to England to purchase an experimental pulp and paper plant. By the end of 1920 some of the experimental plant and staff had arrived in India and a portion of the plant was erected in the old laboratories in order to get the new staff to work and to train a nucleus of the various operators required. Towards the end of 1921 the new laboratories and workshops were put in hand on the new site at Kawlagarh, under the supervision of Perree, the President, the work being carried out by the Public Works Department, to whose officers

the Department owes a deep debt for the great energy and keenness displayed. The construction made rapid progress and the erection of machinery began in 1922; this work proved difficult, and it was not till early in 1923 that the wood workshops and sawmill were running, and the timber-testing laboratories in working order. The next section to function was the experimental wood preservation pressure plant which opened in April, 1923. The sections of timber seasoning, paper pulp and veneers commenced running in March, 1924, having been held back until the new water scheme was in operation. The author had the unforgettable experience of seeing the whole of this great organization in full work in April, 1925, probably the most up-to-date and efficient research plant that has ever been erected in one centre in any part of the world. The staff in charge of this research work under Pearson in April, 1925, was as follows: Mr. H. Trotter, I.F.S., Assistant Forest Economist, who was officiating for Pearson (who had gone on leave); Dr. H. P. Brown (at Syracuse University, U.S.A.), Wood Technology; Mr. W. Raitt, Mr. S. Fitzgerald, Seasoning; Major L. N. Seaman, Timber Testing; Capt. J. H. Warr, Wood Preservation; Mr. W. Nagle, Wood Workshops; and Mr. Ram Dass Tandam, Mechanical Engineer. The post of Officer in Charge of Minor Products was vacant, although Pearson recognized that in this section alone several specialists were urgently needed, and it is a practical certainty that their cost will be far more than covered in a very brief time by the valuable results which their investigations would assure. Pearson roughly estimates (in 1925) the capital cost of the new laboratories and workshops and the current expenses of his branch at Rs.15,71,750, the sanctioned annual budget (1924-5) for the branch being Rs.3,80,000, whilst that of future years, when all sections are fully functioning, will, he says, be in the neighbourhood of Rs.4,50,000. In the author's opinion the money will be well spent, always provided it is not granted at the expense of other as important, though perhaps not so easily understandable, branches. As illustrations of the fact that good interest is being obtained on capital and current expenditure Pearson instances the following: "The North-Western Railway, on the experiments started in 1910 with antiseptically treated sleepers, put up a large creosoting plant last year (1924), capable of treating some 400,000 B.G. sleepers annually. The timbers treated by them were never before used as sleeper

woods and the Department had difficulty in finding a market for these species. The financial gain on these transactions alone would pay a considerably higher rate of interest on the capital expenditure of the Economic Branch than many thriving commercial concerns. A similar plant, dealing with from 250,000 to 300,000 M.G. sleepers in Assam, has been in operation for more than a year, and this plant was based on experiments carried out by the Forest Economist at Digboi in 1915." That Pearson is right in his contention is evidenced by the fact that Sir Clement Hindley, who was a travelling companion on the way home in May, 1925, said to the author that sooner than risk the work of the Economist Branch at Dehra Dun coming to an end, the Railway Department would have to consider the question of financing it or a similar Institute out of the Railway Budget! Pearson continues: "Another instance is that of paper pulp, which, after prolonged investigation, has led to the erection of a pulp factory, which works with bamboos obtained from the State Forests of the Chittagong Hill Tracts. Yet another is that of rifle stock wood which, until the Research Officers went into the question, was all imported from America into India and which is now entirely supplied from the N.W. Frontier Province and Kashmir. Other instances are the turpentine and resin industry, the rosha-oil industry, match, pencil and pen-holder factories, and Indian timbers used for railway wagons, bobbins, hammer handles, billiard cues and sporting requisites." The difference and difficulties which distinguish research into utilization of forest products in India, as compared, e.g. with Canada and America, are not commonly appreciated. For these latter countries the Forest Product laboratories have behind them a large number of wood-working institutes, controlled as Pearson says, by keen business men, who are only too ready to make use of and cooperate with the Research Officers. In India there are but few such, and these situated far from the Institute. It is for this reason that it was found necessary for the Provinces to start Utilization Circles to carry out the early stages of development, leading to more intensive utilization of their timbers and to translate the results, obtained by the Central Institute, into commercial propositions. The branch draws up a monthly Trade Supplement, which is issued with the *Indian Forester*. This gives current prices of timber and minor forest products for India and Burma, together with brief trade notes, notices

of sales, etc. This supplement is much appreciated by timber merchants and local Forest Officers.

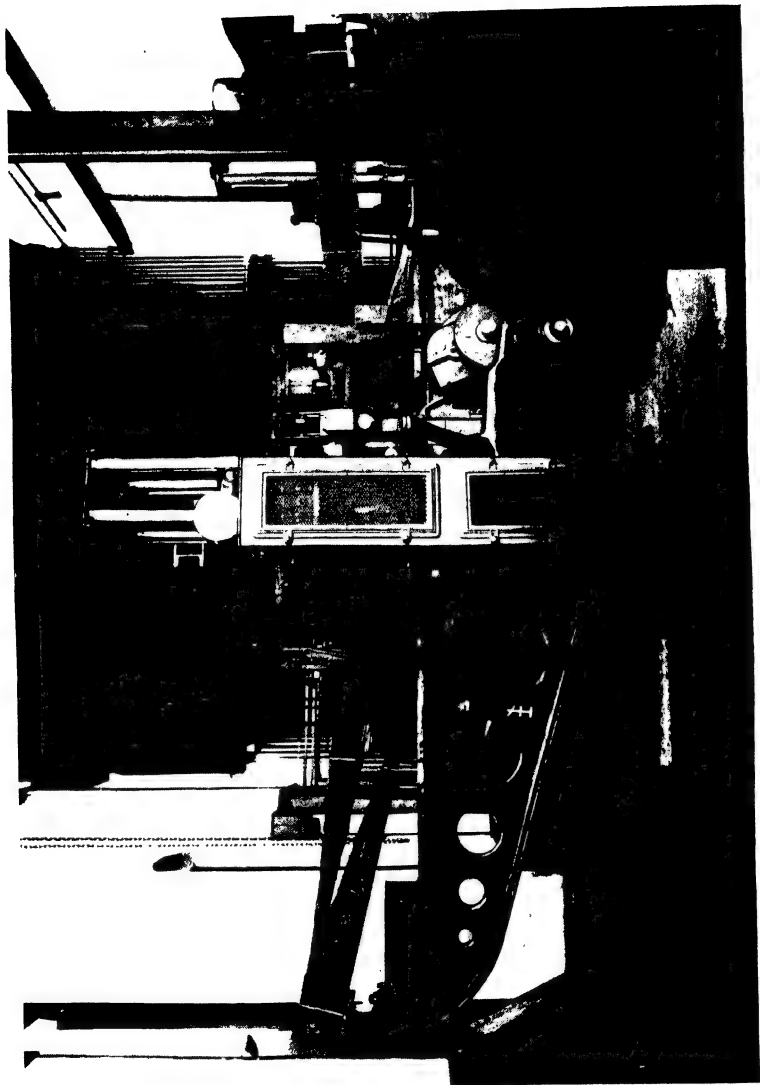
The brochure from which the author has compiled the above brief history of the branch then deals with the different sections in some detail. These can unfortunately only be briefly alluded to.

Wood Technology.—We owe to America the good fortune which enabled this section to be started. The State College of Forestry of the Syracuse University very courteously lent the services of Dr. H. P. Brown, an eminent Scientist and Professor of Technology, to the Dehra Dun Institute for a period of twenty-two months. During this period Dr. Brown prepared photomicrographs of over 180 of the more important Indian timbers, organized the section and prepared a most valuable Elementary Manual on Wood Technology in terms of Indian Timbers for instructional purposes at the Dehra Forest College. Dr. Brown has now returned to his University, but the Government of India have been able to retain his services during his vacations and he is continuing in America the preparation of microphotographic sections, the material being sent to him from Dehra, and is training an officer in Wood Technology for the Institute. It is also proposed that he should prepare a Manual of Indian Timbers in collaboration with Pearson. The author had an opportunity of examining some of Dr. Brown's beautiful work and he would wish to express his high admiration for the ability of this gifted scientist and the great value of the results achieved.

Timber Testing.—In discussing the work of this section Major Seaman writes: "Though this branch of research is still in its infancy (in India) over fifteen important species have been fully tested and many others are being dealt with at the present time. Ten testing machines are kept in constant operation, and two more are to be added to the equipment as soon as possible. In spite of this fact the need for reliable information on the strength of Indian timbers is so great, and important enquiries from timber-using industries, railways and Government Departments so numerous, that the Testing Section has far more work than it can cope with for many years, and only the most urgent problems can receive immediate attention and prompt solution. To meet this great and growing demand the staff are working at utmost capacity and turning out from 1000 to 1500 strength tests and a corresponding number of physical determinations every month."

This class of research work has a great economic value. As

this history will have demonstrated, the Indian Forests contain a very large number of valuable timbers of which until lately only a dozen or so have had a marketable value. Owing to lack of information as to the strength and characteristics of the rest, and the possibilities of their extraction in exploitable amounts, inferior imported timbers have long held a supremacy for certain purposes in the Indian markets. The results obtained in this section are daily demonstrating new values and new uses of many species which have been commonly classified in the past as useless 'Jungle Woods.' The main basis of this research lies in a programme of routine tests conducted by standard methods, and therefore suited both to establish the relative strengths of well-known and unknown Indian woods, and also their relative strengths as compared with well-known foreign species of timber. Tables and charts are prepared showing the relative usefulness of different woods for various structural purposes. These data combined with others obtained by testing full-sized structural timbers form the basis of reasonable grading rules, based on the strength of the timber, and for preparing tables of allowable working stresses for use in the designs of bridges, buildings and other structures. It is evident that this work will lead to the utilization of many previously unused timbers and will result in an immense pecuniary saving to the country. Major Seaman states that such grading rules and tables of working stresses have already been prepared and submitted to the Military Works Department, the Punjab Public Works Department and other important interests. Tentative grading rules for *Pinus longifolia* railway sleepers have recently been drawn up. Tests for spike-holding power in railway sleepers are also being undertaken for a number of timbers and a comparison is being made on various lines with foreign sleeper woods. Major Seaman adds: "As the same kind of work is being done in the United States Timber Testing Laboratory and lists prepared in the same way it is interesting to note that if creosoted Indian *Terminalia tomentosa* be placed in the American list it takes *second place*, being surpassed only by the black locust (*Robinia pseudoacacia*). It stands well above white oak (*Quercus alba*), one of the most highly valued sleeper woods in America, the figure expressing its sleeper value (in quality but not in price) is more than double that figure for Douglas fir. The results of the sleeper study alone, in increased use of Indian woods and decrease of imported woods, will more than



STRUCTURAL BEAM TEST. TIMBER TESTING LABORATORY, NEW FOREST RESEARCH INSTITUTE, DEHRA DUN



STURTEVANT KILN, SHOWING 16 VARIETIES OF TIMBER TESTING SPECIMENS AND *CULLENIA EXCELSA* STACKED
READY FOR DRYING. RESEARCH INSTITUTE, DEHRA DUN

Res. Inst. photo

repay to India the entire capital cost and running expenses of this laboratory."

This opinion on this one species alone shows the necessity of the Sylviculturist, and the Forest Officer generally, keeping himself *au fait* with the progress of research work. In the settled conviction which has held sway for so long that one species only is of major importance be it sâl or teak, etc., important fellings and thinnings have borne hard on the rest, and the same was the case in the craze for the pure plantation. Research work would appear to show that if the Forest Officer can replace on the ground the old type of mixed forest with a better stocking of what is becoming recognized as the marketable species he will be more closely following nature whilst providing the timbers likely to be required by future markets.

Major Seaman also refers to the work being carried out with Indian and Burmese substitutes for American hickory as oil-well sucker rods, which have already met with success, ordnance requirements, tea boxes, axe and hammer handles, etc. In connection with the latter the Military Stores Department have recently decided to place a contract for handles of *Parrotia Jacquemontiana*, always known heretofore as a "forest weed."

Timber Seasoning.—In the past most Indian wood has been utilized in its green or unseasoned state, the exception being teak, the chief supplies of which have come from girdled trees, which have stood in the forest for two or more years before being felled. The seasoning section is setting to work to change this condition of affairs and thus put an end to the deplorable waste which the use of green timber in a hot climate inevitably engenders—warped doors and window sashes which will either not open or, if open, close; drawers which cannot be pulled out or, if out, refuse to go in again save sideways, and a host of other evils and worries. Mr. S. Fitzgerald, an officer of great experience who was previously in charge of Seasoning for the Air Ministry in England, is at the head of the section.

Seasoning work is of two types, open-air seasoning and artificial seasoning. Mr. Fitzgerald describes the work achieved as follows: "Open-air seasoning trials were started in 1914 by the Forest Economist, collaborating with the heads of the Forest Department in India and Burma. Ten thousand planks, scantlings and sleepers were put under observation. These were from thirty-three species of Indian timbers and they were arranged in twenty-two different stations with

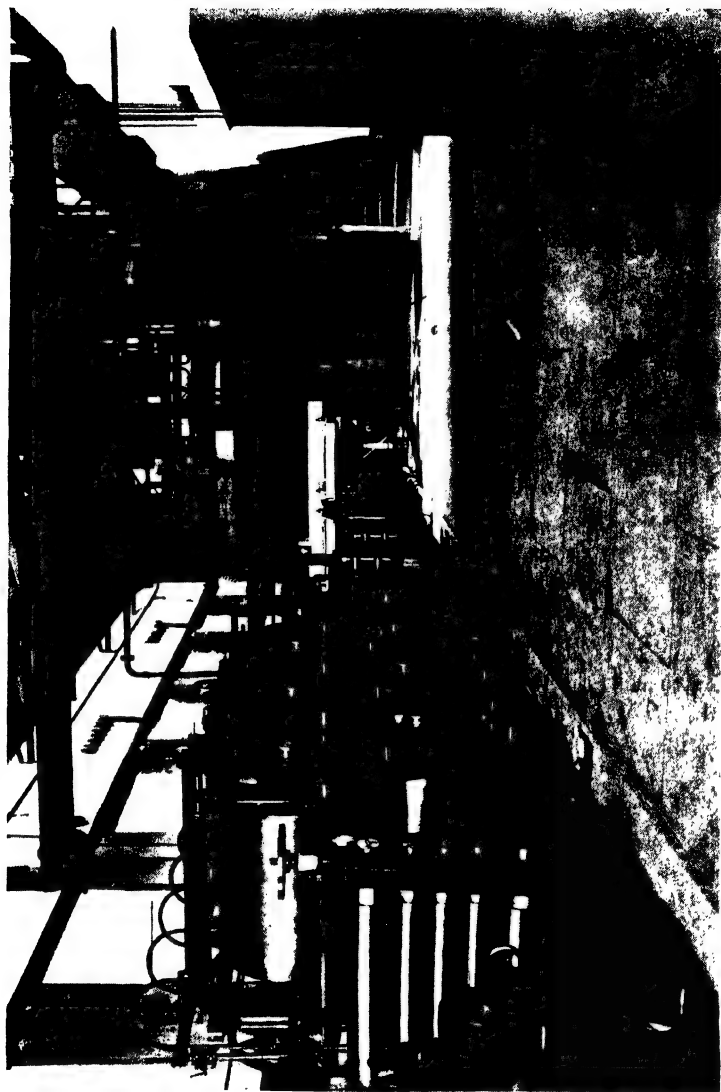
widely varying climatic conditions. Each experiment with each species and at each station involved seven different ways of manipulation. Some trees were girdled before felling, some sawn green, others water immersed for a period before sawing, some barked, etc. . . . Summarized, the general results of these experiments (*For. Rec.*, VIII, Pt. I) showed that it profited to girdle some species and not others, that certain timbers parted with their moisture more easily if water immersed for a period, and that others were best sawn green directly after felling (*vide* Vol. II, p. 26). Above all the importance of careful stacking and protection from sun and weather was clearly proved." In a second series of experiments the values of girdling and water seasoning and the period to allow between felling and conversion were more particularly concentrated upon ; fifty-three species of timbers being under observation as before. Since this enquiry entailed a great amount of travelling and supervision a Seasoning Officer (a specialist from the Forest Products Laboratory, Madison, United States) was appointed for this work. The results of this investigation are published in *For. Records*, IX, Pt. V. Further experiments of this nature are now being completed on Andamans timbers and a few on Indian timbers for special purposes. Another series of open-air seasoning tests are to be made with sleepers, following their course from the time of felling until delivered eventually to the Railway Company (known as Project IV of the Econ. Branch).

"Whilst open-air seasoning was taking its course," says Mr. Fitzgerald, "preparations were proceeding for experiments with artificial seasoning processes. Firstly, a roughly constructed timber dryer was set up in the Institute grounds, and later, at the new Kowlagarh site, fully equipped timber dryers on the two leading systems have been put up. Tieman System—with circulation by water sprays (as used mainly by the United States Forest Laboratory), Sturtevant System—having blower circulation (as used by the British Government for Air Craft timbers). . . . Even the roughly constructed dryer mentioned above showed the immense possibilities of artificial seasoning in India, and it was proved that timber for the most exacting Ordnance work could be brought to maturity in a few weeks instead of years, and with less degrade than usual. As a result the important Ordnance Factory at Jubbulpur is installing dryers which will enable them to considerably reduce the capital locked up in holding timber stocks, and permit



WOOD PRESERVATION PLANT, PRESSURE CYLINDER, PUMPS AND CONTROL BOILER, ECONOMIC BRANCH, FOREST
RESEARCH INSTITUTE, DEHRA DUN

Res. Inst., photo



PAPER PULP HALL, SHOWING DIGESTERS, BEATER, MINERS AND PAPER-MAKING MACHINE, NEW RESEARCH
INSTITUTE, DEHRA DUN

of a big increase in output in the event of any emergency." Compare this with the depot system of the past (Vol. I, pp. 338 to 343) and the accumulations of logs which were so often objected to by the Government of India and the Secretary of State. The American Officer had to resign his post and return home, and there was an interregnum before Mr. Fitzgerald was appointed. He, however, got the new plant running in 1924 and six species of Indian timbers have been artificially seasoned successfully in bulk, and about thirty others tried in a tentative manner. The section has already had demands for assistance and schemes have been worked out for interests in Hyderabad, Madras, Burma, Calcutta, Bareilly and Lahore.

Wood Preservation Section.—In dealing with the work of his section Captain Warr writes: "The history of the section is practically the history of the antiseptic treatment of timber in India, for although earlier investigations into the possibility and desirability of preserving Indian timbers from decay and destruction by insect pests had been undertaken, no conclusions had been arrived at, and no recommendations made, and it was left for Mr. Pearson to institute a series of durability tests on a number of different species of timber treated with preservatives and also on the preservative value of different antiseptics." Owing to the absence of funds the first attempts were limited to the cheapest method, i.e. that of the 'open tank,' in which timbers were immersed in hot oil for varying periods. This investigation was started in 1910, laboratory experiments on the value of twenty-three different antiseptic salts and oils having been commenced in 1909. The laboratory experiments were conducted on stakes which were placed in the ground together with untreated stakes which served as controls. The great value of these early experiments is now being clearly demonstrated, and at least two large preservative plants and one small one have been erected and are now in operation. The open tank experiments were carried out almost exclusively on possible sleeper woods, the sleepers after treatment being laid down in various sections of the railways all over India and kept under observation. One of the results which eventuated was the proof that locality, i.e. varying climatic conditions, had little influence on the results and that proper antiseptic treatment was effective all over India. In 1915 the first experiments with a pressure plant were carried out at Digboi with a few Assam species. The interest of the Railways was aroused by these experiments, and was further

stimulated by the increased price of sâl, deodar and *pyinkado* sleepers. It was therefore decided to erect an up-to-date pressure plant at Dehra Dun. This intention was delayed by the War and it was not till 1922 that the project matured, and the erection of the new plant was completed in 1923 and a Wood Preservative Officer was appointed. This section is also at work on Project IV alluded to under the Seasoning Section. One of the series of experiments now engaging attention is to ascertain the correct proportion of antiseptic to be injected into a timber. In addition to sleepers other departments of constructional work are receiving attention. The early work had shown that *Pinus longifolia*, previously regarded as non-suitable for sleepers, when treated with a suitable quantity of an approved antiseptic is capable of giving at least twelve years' service in the line. One result of this discovery was the erection of a plant at Dhilwan on the N.W. Railway to treat conifers such as *Pinus longifolia* and *Pinus excelsa*. Other species such as *Terminalia tomentosa*, the Dipterocarps and some Assam species have given equally good results and their treatment on a large scale is highly probable. It will be abundantly obvious from what has been said that the work of the section aims at establishing a new industry in India which will have its effect on the revenues of the country.

Paper-pulp Section.—Mr. Raitt, in treating of his section, opens with a strikingly true paragraph which those who have studied the World's timber markets will fully support. He writes : " The resources in paper-making materials of India and Burma have been known and experimented with spasmodically for over fifty years. Every one who has touched the subject has been struck by the vast store of such materials growing in these forests, frequently associated with excellent manufacturing and transport facilities, and, in the case of many species, annually or biennially self-reproductive. The introduction to the paper-making world of wood pulp about 1870, however, sent the subject into oblivion for thirty years, but, about twenty years ago, interest was revived by the rapid growth of opinion that wood pulp, after all, was not destined to be a final solution to the paper-makers' recurring problems of supplies. The more accessible areas of pulp wood were being rapidly exhausted, costs increased with the opening up of more distant forests, and the rapid growth of the world's requirements of structural timber has created a demand with which the paper-maker cannot compete. The sawmill has become a

better market than the pulping plant." Pearson commenced the enquiry into the bamboo resources of the country in India in 1909, and as is now well known there is no doubt that the supplies of bamboos exist in abundance. With this question answered in the affirmative systematical experimental work was started. A commencement was made in a laboratory at the Allahabad Exhibition of 1910-11 under the control of Clutterbuck. When the Exhibition closed the laboratory under Mr. Raitt was transferred to Dehra Dun. As has been already mentioned, a large experimental plant has recently been erected at the new Institute on a scale sufficient to compel factory methods to be used. The work of the past fourteen years, for which great credit must be awarded to Mr. Raitt, has eliminated species which are unsuitable and has led to efforts being concentrated on grasses and bamboos. The trouble experienced was the difficulty in bleaching. This problem Mr. Raitt, as the result of years of patient work, has at length solved. A considerable part of the activities of the section lies in the exploration, in conjunction with the local Forest Officers, of areas regarded as suitable for paper pulp making. The manufacturing and transport facilities are fully explored and reported on to the Local Government concerned. Such Reports have been drawn up for Bihar and Orissa (Cuttack pulp project), for the Tinnevely Hills (Madras) and for the Kasalong areas near Chittagong which are now being worked to provide the material for a pulp mill in Calcutta.

Minor Forest Products.—The chequered history of this branch of work has already been alluded to. In the early days Pearson started research which led to the establishment of the Rosin and Turpentine Industry in the United Provinces, a steam distillation plant being erected at Bhowali, near Naini Tal; and an investigation into the possibilities of Rosha grass oil industry, which has resulted in eleven steam kilns now running in the Rosha grass areas in the Central Provinces. The great promise of these early days was not, however, followed up. Little more was done till Mr. W. A. Robertson (from Burma and at present Conservator of the Utilization Circle there) was appointed to the charge of the section in 1922. He at once commenced to organize the section on sound lines, and by the time he left the Institute a year later, he had laid the foundation-stone of a really practical section. His first step was to make himself acquainted with the commercial possibilities and the available supplies of minor forest products.

He also got into touch with likely markets and contractors in order to link up the existing gap between the local Forest Officer and the commercial world. When Mr. Robertson left the Institute the work ceased, and remains in abeyance. The Economist and Assistant Economist were in officiating charge, but systematic research remained out of the question. During seven years at the Institute Mr. J. A. Pilgrim carried out excellent work in connection with tans ; the sub-section was abolished in 1923, owing to the slump in the tanning trade and shortage of funds at the Institute. In connection with minor products much work of an incalculable potential value remains to be done.

Wood Working, Veneers and Sawmills—Space does not permit the detailed description of this section. It provides and prepares materials required for the experimental work in other sections (the Timber Testing Section requires some 18,000 prepared specimens a year) and carries out original work of its own. Mr. Nagle is an experienced wood-worker and has under him a competent staff. The veneer plant is one of the interesting features, the rotatory cutter will peel logs up to 3 feet long. Owing to the climate panel work in India has always proved most disappointing. Quite recently veneer panels have been made use of. The hall and other parts of Government House, Shillong, were panelled in this way at the wish of Sir William Marris when Lieutenant-Governor of Assam. The photograph, for which the author is indebted to Sir William, now Governor of the United Provinces (1925), who described the work to him, shows the hall. The walls have 5-ply, and the roof 3-ply, panels. On this subject Mr. Trotter writes : " As a result of the high hopes held out by the Economic Branch in the use of ply-wood for panelling, the Imperial Works Department of New Delhi have decided to panel the new Legislative Assembly and Council Chambers with panels of three-, five- and seven-ply wood as being the only solution for employing large, handsome panels which would stand up against the adverse climatic conditions of Delhi." A log pond 120 feet by 6 feet deep with an overhead moveable gantry leads up to the sawmill. On arrival in Dehra the logs are sunk in the pond till required for use.

Plenty of work is found for the mechanical sub-section. There are now in the workshops twenty electric motors, thirty complicated wood-working and timber-testing machines, a 150 B.H.P. Babcock & Wilcox boiler, in addition to the paper-



VENEER PANELLING IN THE HALL OF GOVERNMENT HOUSE, SHILLONG, ASSAM

Sir William Harris, photo.



FRONT VIEW OF VENEER SHOP AT THE NEW KOULAGARH SITE. THE ROTATORY CUTTER PEELING A LOG. FOREST RESEARCH
INSTITUTE, DEHRA DUN

Res. Inst., photo.

pulp, creosoting and seasoning plants; since there is no mechanical engineering firm within many miles of Dehra Dun the Institute has to be self-supporting in this respect.

THE BOTANICAL BRANCH, 1906-25

The work of this branch has to some extent been handicapped by inadequacy of staff. Almost throughout the period the branch has had one Imperial Officer only, whose time has been largely taken up with routine work, education, etc. One Imperial Assistant was appointed in December, 1913, and remained up to June, 1915. In 1921 three Imperial posts were sanctioned, namely, Ecologist, Mycologist and Systematic Botanist, but except for broken periods totalling about a year and four months the Forest Botanist has held all three posts. Mr. Hole was in charge of the branch to 1924. The work undertaken by Hole falls under the following heads: (1) Education, (2) Systematic Botany, (3) Diseases of Trees, (4) Ecology.

(1) *Education*.—A Botany Manual was published in 1909 which was pronounced by Sir David Prain, then Director of Kew, to be "excellent as a textbook; quite up to date and clearly and concisely written." (2) *Systematic Botany*.—The principal object of this work has been to disseminate as widely as possible among Forest Officers and economic workers a good knowledge of the names and economic uses of forest species, firstly by encouraging the publication of floras and descriptive lists and, secondly, by identifying specimens for inquirers. A scheme prepared by the Botanist and approved by the Board of Forestry in 1913 recognized that two distinct types of publication are required: (a) Floras to serve as detailed books of reference and (b) Descriptive Lists or handy pocket-books dealing with small areas and designed especially to help non-botanists in the identification of their local species. A Flora has been recently published for the Punjab and two Descriptive Lists for the Central Provinces, while in other Provinces this work has been temporarily delayed owing to shortage of staff caused by the War. For satisfactory identification work, in addition to a well-equipped botanical library, a good herbarium is essential, and since 1906 more than 20,000 sheets have been added to the Dehra Dun herbarium, in addition to Mr. Duthie's valuable Saharanpur collections which were incorporated in 1908. A museum collection showing specimens and illustrations under glass has been initiated. Considerable assistance has

been given to economic workers in distinguishing the grasses valuable for paper pulp and other economic species. Incidentally this work has resulted in the discovery of several new species. (3) *Diseases of Trees*.—Investigations were undertaken with the object of suggesting methods of controlling such fungi as those affecting the blue pine (*Trametes pini*), sissu (*Fomes lucidus*) and sâl (*Polyporus shorea*). In the case of the latter two considerable work on soil aeration in relation to root diseases was carried out. (4) *Æcology*.—In 1909 and again in 1911 the Botanist pointed out that, in India, for each main type of woodland there appears to be a parallel type of grassland, capable of thriving under similar conditions of soil and moisture. This parallelism is of considerable importance in afforestation work and in indicating the treatment necessary to secure the reproduction of the forests. It is interesting to note that a similar parallelism was independently recognized by other observers in the vegetation of the British Isles in 1911.

Mr. R. N. Parker, the present Forest Botanist, dealing with root diseases, writes in 1925: "The post of Mycologist has never been filled and meanwhile no progress has been made with the investigation of spike disease in sandal which has been on the programme of the Forest Botanist for years. Mycological work seems likely to assume more and more importance especially in the case of plantations. The root disease of *Dalbergia Sissoo* makes it impossible to rely permanently on this species for irrigated plantations in the Punjab. A root disease of *Pterocarpus Marsupium* recently nearly destroyed a small experimental plot of this species in Dehra Dun, and there are similar diseases on sâl and other trees. So far no definite measures for controlling these diseases have been devised, and without a detailed study of the causative agent it does not seem probable that satisfactory remedies can be suggested. In the case of one of these diseases, namely, the root fungus of *Dalbergia Sissoo*, work in progress makes it seem probable that the fungus seen associated with the disease and hitherto always considered the cause is only secondary and does not start the attack."

Parker had been chiefly occupied with the herbarium. In 1925 there were nearly 40,000 sheets, of which 18,000 had been collected in the preceding four years. Amongst these sheets are specimens collected by Royle, Wallich and others 80 to 100 years ago.

Work is being started to see if the unexpected failure of certain species of trees from other parts of India is due to the absence of specific organisms such as mycorrhiza.

"Another direction," says Parker, "in which work requires to be done is in the case of species with a wide distribution. Specimens grown from seed collected in various portions of the range of the species should be grown side by side to see which gives the best results. . . . Burma teak seed, for instance, is sown in South India with complete confidence which may or may not be misplaced. *Albizzia Lebbek* grown in North India from seed collected in South India gives very poor results compared with the same tree from local seed."

To some extent the Botanist in the past has been occupied by silvicultural research, a fact now recognized in the Institute itself. Yet it is realized that much work remains for the Botanist to undertake in the evergreen forests of South Tenasserim, Assam and possibly in Madras. The distribution of such a species as the deodar has been recently shown to extend eastwards of the limits previously assigned to it by Botanists, a forest of this species having been discovered in Nepal at a considerable distance from the supposed limit of the Jumna River. The systematic section requires the time of a whole-time man and Mycology is likely to make demands upon a staff which are at present incalculable. The close study of Indian Forest fungi has now become an urgent matter. Such diseases as the spike of sandal, about which nearly as much was known, and this amounts to very little, over a quarter of a century ago, still remains an enigma; it has resulted in the loss of a large sum of money. And *Fomes lucidus* is causing heavy losses in the Changa Manga Plantation.

THE ENTOMOLOGICAL BRANCH

The inauguration of the post of Forest Entomologist at the end of 1900 and its subsequent confirmation has already been alluded to. The early work involved was that of the pure pioneer, for there was no such foundation, either in published records of investigations already begun, as in the case of silviculture or the fine work of Botanists which the Forest Botanist had to his hand, upon which to build. The author held this post, with two breaks, for nine years (to end of 1909). During a short furlough in 1907 Mr. C. E. C. Fischer officiated in the post. A considerable part of the investigations carried out during numerous tours was published by the Secretary of

State in *Indian Forest Insects* (Coleoptera) which appeared in 1914, its issue synchronizing with the outbreak of the Great War. The following comment by Perree, who had been President of the Institute for six years, made in 1925 (*Jour. Roy. Soc. Arts*, LXXIV, p. 21) summarizes this period : " Mr. Stebbing was the first Forest Officer employed on research work, the branch of Forest Entomology being the first to be created, well in advance of the Forest Research Institute. For years Mr. Stebbing worked quietly and gained a vast amount of information and made a general review of Entomology as applied to Indian Forests, and the Department had greatly benefited by his work."

The second period of development started with the appointment of Dr. A. D. Imms as Forest Zoologist in October, 1911. Dr. Imms was not a member of the Imperial Forest Service. He held the post for sixteen months and made considerable progress under three main heads : (1) a reference collection of insects, which had already been commenced, but to which he gave untiring attention, (2) a reference library, for the commencement of which funds had now become available and (3) adequate laboratory and insectary equipment, for which funds were also granted. Imms carried out investigations on scale insects—the lac insect (*Tachardia lacca*) and the *Pinus longifolia* scale (*Ripersia resinophila*). A Memoir was published on the biology of the former species and its parasites. Imms resigned in 1913 and Mr. (now Dr.) C. F. C. Beeson was appointed to the post. Beeson had received his Forestry training at Oxford University and had undertaken further courses in Entomology before joining in India. It was his misfortune that he should not have had a few years' experience of Assistant and Divisional Officer's work in a Division, which, in the opinion of many qualified to judge, should precede an appointment to the Institute. No Research Officer can thoroughly appreciate the work or the difficulties facing the Divisional Officer in his management of an area of forests unless he has been through the mill himself. It cannot make for the efficiency of the Institute in the future if this factor is lost sight of. It does not apply to all the posts, but it certainly does to the heads of branches.

Dr. Beeson has carried out some valuable work since his incumbency. In discussing the work he writes : " The policy during the ensuing twelve years has been primarily directed towards an extensive survey of the forest insects of India and

Burma from an œcological standpoint. The faunistic conditions in the different types of forest have been sampled as widely as possible by field collection and by elaborate rearing work in the Dehra Dun Insectary. For the study of wood-boring insects special types of cages were designed in which infested timbers from all parts of British India could be maintained under approximately natural climatic conditions.

At the same time detailed biological studies were carried out on the more important pests. With the exception of an investigation of the beetle-borer of teak, *Xyleutes ceramicus*, carried through entirely in Burma, successful œcological work has been necessarily restricted to those species that are indigenous in North-West India. e.g. *Hypsipyla robusta* (tom), *Hoplocerambyx spinicornis* (sâl), the genera *Sphærotrypes*, *Polygraphus*, *Stromatium*, *Sinoxylon* and *Dinoderus*, etc.

A museum of damage by forest insect and animal pests has maintained a steady growth. The extra staff sanctioned in 1919 has not yet materialized. In December, 1920, Dr. M. Cameron was appointed Systematic Entomologist; his health gave way and he was followed in 1923 by Mr. J. C. M. Gardnar. There are five Assistant Entomologists.

The investigation work undertaken has been published in the Research Institute publications. The classic example of the suppression of a most serious attack of the longicorn borer, *Hoplocerambyx spinicornis*, whose ravages were first commented upon by the author as long ago as 1899, furnishes a striking illustration of the practical possibilities of control work in this branch. This pest was threatening the destruction of the Thano Sâl Forest in the Dehra Dun Division. As a result of the control operations introduced by Beeson (described in *I. For. Rec.*, Vol. XI, Pt. viii) this serious infestation was got under control and a valuable forest and a considerable revenue thereby conserved.

THE CHEMICAL BRANCH, 1906-25

The chemical work undertaken by Drs. Warth and Leather in connection with the Forest School has been alluded to in a previous volume (II, p. 607). Until the year 1914 no up-to-date laboratory was available for chemical research work. With the opening of the Institute building at Chandbagh in that year a separate building in the grounds provided the much-needed equipment. Perree thus describes the work of this branch up to 1922: "The lack of accommodation and

appliances in 1907 and the following years limited the scope of the work to chemical valuation of materials submitted by various officers and departments. The provision of a laboratory and equipment in 1914 gave the Chemist an opportunity of proving the value of this branch. The demand for analytical work steadily increased and left the relatively small staff little time for original work. Nevertheless, a good deal of investigation was carried through with the object of demonstrating, on a commercial scale, the possibilities or otherwise of developing certain industries. The Chemical Section is, of necessity, closely associated with the Economic Branch, and the two must continue to be interdependent. It is possible only to mention a few of the principal investigations. These comprise tanning extracts chiefly in relation to mangrove bark, the distillation of turpentine from the rosins of Indian pines, resulting in the introduction of the redistillation process in our present distilleries, the possibility of pine-needle oil and the chemical properties of the natural varnish of *Melanorrhæa usitata* which have been proved to be identical with Japanese lacquer varnish. The first researches into the manufacture of thymol from "Ajowain" seeds were made at the Institute, and have resulted in the erection of a factory in the Dun which now supplies a large part of the world's requirements. Latterly the manufacture of turpentine, rosin and gum from the gum rosin of *Boswellia serrata* has been investigated, and it is hoped will yield important results. A very large number of other minor investigations have been carried out."

Mr. Puran Singh was appointed Forest Chemist in 1907, and retained the post with short breaks till 1917, carrying out valuable work. Mr. C. E. C. Cox, I.F.S., held the post for a year (1918-19) and then Dr. J. L. Simonsen was appointed and continued to hold the reconstituted post till 1925, when he resigned. A new incumbent had not been appointed. The work which has already been carried out by this branch has served to show its unquestionable value. But it may be confidently predicted that it will prove to be but the precursor of a far wider series of investigations once the Minor Products Section is restarted with a suitable staff. On this head the Annual Report of the Research Institute, 1923-4, page 83, reads as follows: "The absence of an officer in charge of the Minor Forest Products has been very severely felt and practically no new problems have been suggested during the year under review. In addition very great difficulty has been experienced

in the collection of material for investigation. It is hoped that the appointment of a full-time officer will not be further delayed."

PROVINCIAL RESEARCH

It has been already shown that the Government of India quickly recognized and fell in with the wishes of Local Governments to appoint local officers to undertake research within the Provinces. This necessity first made itself felt in Sylviculture, Working Plans and Economics. It was, perhaps, unfortunate that the appointment of local Sylviculturists should have led to a restricted development of the branch at Dehra. From the description of the work already given it will be apparent that there is scope for a larger and purely sylvicultural staff at Dehra, working in close collaboration by constant touring with the local Sylviculturists, the statistical work being relegated to an officer who will have sole charge of this section. The latter would then work in the Provinces in collaboration with the Conservators of Working Plans, who, it may be foreseen, will themselves require an Assistant in charge of the local work of this nature in their offices.

So far as the Local Governments are concerned, the advance made by the appointment of Conservators of Working Plans and Sylviculturists is of the greatest importance. By 1925 Conservators of Working Plans were present in the United Provinces and Burma; Utilization Conservators in Burma and the Punjab with a Utilization Officer (part time) in Bengal; and Sylviculturists in the United Provinces, Burma, Central Provinces and Bengal. Madras and Bihar and Orissa each have a Forest Research Officer, whose duties are primarily sylvicultural research. In Burma the W.P. Conservator has sylvicultural, botanical and entomological (vacant) branches under him. The Utilization Circles in the United Provinces and Bombay are held in abeyance. Assam has no Research Officers.

There can be little doubt that if real and rapid progress is to be made under modern conditions, and if the old forests, which latter-day progress has disclosed methods of exploiting, are to be effectively replaced by new crops, the appointment of officers to fill local research posts is imperative. The hard-worked Divisional Officer is even less able now, than in the past, to carry out the necessary investigations and experiments. In the comparatively newly instituted work of correctly thinning the increasing areas of young crops a great deal of sylvicultural work of the very first importance requires to be

carried out. It is impossible to rate too highly the importance of the Sylviculturist and his work during the next decade or so in India. But his operations seem to require to be restricted to sylviculture—and not to be overloaded with statistical work, which is quite outside his sphere.

CHAPTER XV

FIRE PROTECTION IN THE FORESTS OF INDIA AND BURMA, 1901-25

IN no other branch of Forest Administration in India have opinions so changed as in the matter of fire protecting the forests. It will be remembered that before the end of last century the first heretical suggestions (for they were so considered) were made questioning the correctness of the theory and practice of indiscriminate fire protection in the Burma teak forests. The officer who voiced that opinion was the late H. Slade, a brilliant Forester. He wrote an article entitled "Too much Fire Protection in Burma," which was published in the *Indian Forester* (May, 1896). Ribbentrop, Inspector-General, in *An. Rep. For. Ad.*, 1896-7, pp. 27-31, summarized all the official information and the letters of May, July, and August, 1896, in the *Indian Forester*, and gave it as his confirmed opinion, based on his knowledge of the Burmese Forests, that fire protection was essential there as elsewhere in India. It may be stated at once that incalculable direct and indirect benefits had resulted through the introduction of fire protection in the forests of the country. Its application to every type of forest, and the importance attached by Forest Officers to the rigid enforcement of such protection over large areas, had resulted in the Government taking up the position that the law was to be obeyed in this respect and that penalties for disobedience were to be unswervingly inflicted. Owing to fire protection it is probable that the people of India learnt the sooner to realize the Government's determination, wavering although it often was, to conserve its Forest Estate, than would have been the case if such grave importance had not been attached to their protection from this source of damage. But the fact remains that towards the close of the century a few officers were questioning the value of fire protection under certain conditions; whether, in other words, the regeneration of the

forests, and the species in question at the time was teak, was not suffering through the rigid protection from fire.

The present century has witnessed what can only be termed a revolution in this matter, and the practical experience which has been gained in India must prove of equal importance, local conditions being allowed for, to all the semi-tropical and tropical forests of the world.

Since this enquiry was first started in Burma we may commence by considering the lines upon which it proceeded in that Province. It may be said, however, that the enquiry once taken up resulted in investigations, aided by the Sylviculturist, which have led to the introduction of a procedure in different parts of India which may result in the attainment of objects, sylvicultural and other, far remote from the mere protection or otherwise of a forest from fire.

Fire Protection in Burma.—The following summary of the history of fire protection in Burma during the period here considered is given in an Inspection Report ("Note on a Tour of Inspection in Burma," 4th March, 1914) by Sir George Hart, Inspector-General of Forests. After referring to Slade's letter on the subject in the *Indian Forester*, Hart wrote: "This subject was carefully considered in 1897, when it was decided on the advice of the then Inspector-General of Forests, Mr. B. Ribbentrop, that fire protection should be extended as far as funds and administrative considerations allowed, with the result that between 1896-7 and 1906-7 the area under protection rose from 1856 square miles to 8153 square miles.

The decision of 1897 did not, however, satisfy many Burma Forest Officers, and the opposition to the continued protection of all classes of forests continued to grow steadily. In the *Indian Forester* for March, 1905, Mr. Troup published the results of enumerations of the stock carried out in two adjoining plots in the Tharrawaddy Forests, one of which had been protected successfully for nineteen years, and the other of which had been burnt over annually. These enumerations were confined to poles of 1 foot to 2 feet in girth, to poles and saplings under 1 foot in girth, and to seedlings: reduced to the numbers to be found on 50 acres they showed: (i.) a much larger proportion of unsound and dead stems to sound stems in the protected plot, (ii.) ten times as many seedlings in the unprotected plot as in the protected plot and (iii.) that about half the sound stems in the protected area were in danger of suppression and would probably disappear, while those in the

unprotected plot were mostly sound, well-grown, without sign of fire damage and in little danger of suppression. Mr. Troup concluded that with continued protection teak must eventually disappear from the protected plot."

Troup's results were published in the *Indian Forester*. The writer was in Burma, in Tharrawaddy, at the time and, being Hon. Editor of the magazine, suggested that the investigation should be carried out in order to obtain "copy" which would be of interest to Burma Forest Officers. Hart continues: "In the cold weather of 1906 Mr. Beadon-Bryant, then the Chief Conservator of Forests, visited the Tharrawaddy Division with the object of obtaining further information as to the effects of fire conservancy; and arranged to have further countings made. Among the plots counted on this occasion were four, covering an area of 275 acres, which had been enumerated twenty-two years previously, when the Working Plan was made. The results obtained in these plots, and in six others, confirmed generally the conclusions arrived at by Mr. Troup, viz. that the decrease in the number of teak stems below 1 foot and between 1 foot and 1 foot 6 inches in girth was most conspicuous in areas which had been continually protected from fire for many years.

In 1907 Mr. Bryant compiled a valuable Memorandum on fire conservancy in Burma. After summarizing the past history and dealing with the countings made in the Tharrawaddy Forests, which he considered to have proved conclusively that prolonged fire protection had resulted in a marked decrease of the younger classes, he recorded, as a result of his many tours in the Province, the opinion that the combination of the selection system with fire protection was gradually but surely killing out the teak in all the moist forests of Burma, that is to say, over hundreds, if not thousands, of square miles. He then referred to the benefits to be derived from fire protection and proceeded to classify the forests of Burma into three groups: (a) Forests in which the valuable species are found with an undergrowth of dense periodically and gregariously flowering bamboos, as well as forests of a moist evergreen nature where, with the aid of fire protection, evergreen is encroaching on the teak. (b) Forests with an undergrowth of less dense bamboos which flower sporadically as well as gregariously, and, therefore, are more favourable to reproduction. (c) Forests with an undergrowth of shrubs, herbaceous plants and grasses only, in which the more valuable species

occur in a mixed or pure state (the latter mainly confined to cutch (*Acacia Catechu*)). He considered that fire protection should be abandoned in class (a), that it was probably beneficial in many forests of class (b), though, perhaps, not possible to maintain owing to the manner in which classes (a) and (b) are intermixed, and that it was certainly beneficial in class (c), where it should be continued and extended.

Mr. Bryant submitted his Memorandum to the Local Government through the Inspector-General of Forests, who, while agreeing generally to the proposed classification and treatment, was unable to recommend that these should be brought into force at once, and advised that in each Circle or Division suitable areas of sufficient size should be selected, where the effects of the abandonment of fire protection could be carefully watched and the system extended from year to year, if the results justified such action. These recommendations were accepted by the Local Government and the necessary orders were issued in October, 1907. Subsequent to this, there is nothing of particular importance to note, for the Burma Conference of 1910 does not appear to have paid very much attention to this important subject, confining itself to passing a resolution that fire protection in plantations is ordinarily unnecessary after ten years.

In 1907-8, when the orders referred to above were issued, fire protection was in force over 7327 square miles. In 1911-12 the area over which the protection was attempted amounted to 6750 square miles. In other words, there has been a reduction of 10 per cent which, though it may be regarded as a start, can hardly be said to prove the general adoption of the views set forth by Mr. Beadon-Bryant in 1907."

Blanford, Conservator of the Working Plans Circle (in a Memorandum dated 30th March, 1925, to the author), brings the matter up to date in the following :

"Sir George Hart recommended that the classification advocated by Mr. Beadon-Bryant should be carried out over every Forest Division in Burma and that subject to certain reservations fire protection should be abandoned in class (a), i.e. forests in which the valuable species are found with an undergrowth of dense periodically or gregariously flowering bamboos, as well as forests of a moist evergreen nature where, with the aid of fire protection, evergreen is encroaching on the teak. He did not advocate that the abandonment of fire

protection in any class of forest should be necessarily either total or permanent, and suggested that fire protection should be given up for a period to be followed by further protection. He pointed out, however, that the results of fire protection likely to be attained might prove to be incommensurate with the expenditure involved.

Following Sir George Hart's inspection, reduction of fire protection was, however, only gradually accomplished in spite of the opinion of the vast majority of Forest Officers in Burma in favour of considerable abandonment. The figures are as follows : 1913-14, 4548 square miles protected at a total cost of Rs.200,528 ; 1914-15, 3378 square miles at Rs.144,499 ; 1915-16, 2680 square miles at Rs. 114,048 ; 1916-17, 2474 square miles at Rs.112,867 ; 1917-18, 1750 square miles at Rs.76,449 ; 1918-19, 1347 square miles at Rs. 65,384 ; 1919-20, 1277 square miles at Rs.58,877 ; 1920-1, 1215 square miles at Rs.25,055 ; 1921-2, 697 square miles at Rs.25,055 (for nine months only owing to Forest Year being altered to 31st March) ; 1922-3, 122 square miles at Rs.13,742.

The area fire protected in 1923-4 was only 142 square miles at a cost of Rs.16,731 ; a very considerable reduction from the figures given by Mr. Hart for 1911-12, when fire protection amounted to 6750 square miles at a cost of Rs.243,726. The present policy with regard to fire protection is generally to confine it to regeneration areas or, outside such areas, to areas where it is known to be beneficial and financially justifiable.

Within the last three or four years there has been a section of the Department in favour of giving up fire protection in young regeneration areas in favour of early and repeated burning. It is believed that the disadvantages of this method, in that it delays the closing of the canopy, have now been proved. At the same time unless fire protection in young regeneration areas can be absolutely certain, early burning does form a better insurance against the damage of a late fire. With the exception of regeneration areas, fire protection must be for the present experimental in areas of dry forest. Although fire protection in dry areas is undoubtedly beneficial, it has still to be proved that the operation is financially justifiable."

This reproduces the position at the present day in the Province in which the enquiry originally started.

It will be of interest now to quote the somewhat guarded

opinions on the subject in the Government of India's Reviews of Forest Administration for the quinquenniums 1909-10 to 1913-14 and 1904-15 to 1918-19.

It may be premised that the first publicly announced statement questioning the advisability of fire protection in the moist sâl forests came it is believed from W. F. Perree, from Goalpara in Assam. During a visit to Goalpara in 1906 the author was shown areas of sâl by Perree in which the latter had been carrying out observations which tended to show that sâl natural generation and saplings and poles in these moist forests were almost completely absent or very deficient in the fire protected areas. The matter is alluded to in the Government *Review* to be quoted. In the *Review* (No. 903 F., 2081, dated 21st July, 1915) on the 1909-10 to 1913-14 quinquennium we read: "Fire protection measures consists chiefly in maintaining cleared fire lines, external and internal, in organizing an efficient system of patrol, in enlisting the cooperation of the local population in extinguishing any fires which may arise and in burning inflammable grass lands early in the season.

During recent years the method of early burning has been extended experimentally to some Himalayan forests which are more than usually inflammable, and where regeneration operations are not in progress, and to areas in other parts of India in which the stock is not of sufficient value to justify the cost of complete protection.

Now that fire-protection measures have been carried out over considerable areas for several decades it is possible to come to some conclusion regarding their effect. In the majority of cases the forests have greatly benefited, and there can be little doubt that in many types of forest the improvement that has occurred in the growing stock has been due mainly to the effects of fire protection. At the same time, it must be admitted that in certain cases fire protection, so far as the natural regeneration of the forests is concerned, has been decidedly harmful as the encouragement given to inferior species and weeds has wholly or partially prevented the survival of the principal species. This result has been observed for some time past in the moister types of teak forests in Burma, and it is now generally recognized that in forests of this class fire protection should be abandoned. . . . It is doubtful, however, whether in teak forests of this class adequate reproduction can be secured merely by abandoning fire

protection and concentrated regeneration measures will probably also be required. Another important example of the adverse effects of fire protection on regeneration has recently come to light in the sâl forests of the Bengal and Assam Duars, where continued protection has converted the undergrowth, which previously consisted largely of savannah grasses, into a dense mass of evergreen shrubs and *san* grass, and has so affected the soil æration that sâl seedlings entirely fail to establish themselves. Intensive weedings and experiments in cutting and burning the undergrowth have so far met with little or no success, and it is possible that clear felling and artificial regeneration with the aid of field crops may prove to be the only satisfactory method of ensuring the permanence of the sâl in these very valuable forests."

This latter does not wholly explain the reasons for the difficulty in obtaining sâl regeneration in the Duars Forests, but this problem will be dealt with in the chapter on Sylviculture. In the *Review* (No. 1450 Forests, dated 29th November, 1920) for the 1914-15 to 1918-19 quinquennium the area over which special protection was attempted had decreased by nearly 9 per cent, increases in some Provinces being set off by reductions in Burma from 4548 square miles to 1347 square miles, and in Assam from 1440 square miles to 162 square miles. The following might have been written thirty years earlier. It has the same note running through it and sufficiently explains the welcome with which the average Forest Officer received the new ideas on the subject, once he could assure himself that the sylviculture of his forests would not be injured but positively improved. "The average success, 95.5 per cent of the area attempted, has been a little better than in the previous quinquennium, though the reliability of the figures supplied is often open to doubt, and the nature of the season has, more often than not, more to do with the measure of failure or success than the protective methods adopted. The difficulties of ensuring that lines shall be properly cleared and burnt within the short time so often available for the purpose, in obtaining effective patrolling, in securing labour to extinguish fires in unpopulated and hilly tracts of country and in inducing the cooperation of the people, who for centuries have been accustomed to burn to obtain fresh pasturage, render the problem of protection a most intricate one, particularly when it is remembered that one ill-disposed individual may, without running the slightest

chance of detection, burn many thousands of acres by a single act of incendiarism. The absence of loss of life and property, which so often occurs in forest fires in North America, leads to little attention being paid by the public to forest fires in India, and until some public interest on the subject is awakened it is difficult to see how there can be real improvement." It is to the great credit of the Department that men within its ranks were found possessing the qualities of patient and close observation which a scientific training can give, who, to all appearances, have found a solution to some of the above difficulties, a solution which may mark a turning-point in this difficult branch of protection work. The Government of India *Review*, which in itself is likely to become historical, continues:

"The question of the abandonment of fire protection was discussed in some detail in the *Review* for the quinquennium ending 1913-14. It only remains to add that there is a steadily increasing tendency to abandon protection in moist forests and those in which it is liable to foster a growth of trees and shrubs inimical to the regeneration of the principal and more valuable species, or to adopt the method of early burning in areas where fires are particularly dangerous and destructive, or where the growing stock is of insufficient value to justify complete protection. That rigid and perpetual fire protection in many moist tropical forest areas is not only a waste of money, but absolutely inimical to the regeneration, and in some cases to the very existence of the more valuable species, admits of no doubt. On the other hand, it seems desirable to sound a note of warning and again to draw attention to the fact that in many types of forest the improvement which has occurred in the growing stock since the areas came under the management of the Department is due mainly, if not entirely, to successful fire protection. All localities cannot be subjected to the same treatment, and there is evidence, in some places, of a tendency to abandon fire protection to an extent that can hardly be considered justifiable. Fire may, and in many cases must, be used to obtain satisfactory regeneration, but once the young crop is established, the advantage even in moist forests would seem to lie with protection, unless, when the necessary stage of growth has been reached, occasional or perhaps even annual firing is necessary in order to diminish the risk of insect pests or to prevent a too luxuriant evergreen growth leading to excessive

moisture in the soil and the encouragement of dangerous fungoid diseases "

The *use* of fire as an aid to regeneration and silviculture generally will be dealt with in the chapter devoted to that branch of forestry. The main problem is, however, of such importance that it will be valuable to consider briefly the present methods and views of each Province.

Bengal.—In the northern hill forests of Darjeeling, Kalimpong and Kurseong Divisions and in the Jalpaiguri and Buxa Divisions at the foot of the hills 674 square miles are protected from fire by the usual cleared traces and lines and the appointment of fire patrols. The Reserved Forests of the Chittagong and Cox's Bazar Divisions were quite recently brought under fire protection. There is no protection in the other Divisions, nor to any of the protected or unclassified forests. The harm done by fire protection in the moist type of *sâl* forests will be dealt with elsewhere.

Assam.—Fire protection was abandoned in Goalpara Division in 1915-16. In this connection Perree wrote (1922): "The interesting fact in connection with the Goalpara Forests is the gradual suppression of the *sâl* by an evergreen growth which has been favoured by protection from fire. At the present time, with the exception of some of the higher levels on which a grass undergrowth still prevails, the natural regeneration of the *sâl* forests has practically ceased. . . . In Kamrup the best forests which are on the northern belt of the Khasi Hills have been extensively worked in the past, and the *sâl*, as in Goalpara, has ceased to regenerate itself under prolonged fire protection." Fire protection is still maintained in the forests near Shillong in the Khasya Hills, but has been given up elsewhere.

Bihar and Orissa.—At present the Reserved Forests of the Province are protected from fire in the usual way at a cost of Rs.65 per square mile, and Mr. Dicks, the Conservator, holds the opinion that this protection is necessary. The most valuable forests are those of the old Singbhum Division (now split up into four Divisions), where *sâl* regeneration is for the most part abundant, and the Sambalpur Division. The question of "early burning," that is, departmentally firing the forests in the cold weather as soon as the material on the forest floor is dry enough to burn, may be discussed here since the principle involved applies to every Province in which the method is advocated or in force. The object is to burn inflammable material (it may have to be done more than once) at

the stage when a fire will have its least intensity, and consequently do very little or any damage to the trees. The same fire occurring during the hot-weather season often has the most serious consequences. As the extracts from the Government of India *Review* above quoted indicate, in the majority of cases it is impossible to definitely insure a forest from either deliberate incendiarism or an accidental fire, whatever the cause of the latter. In such cases areas of natural regeneration are wiped out. In the case of the Porahat and Saranda Divisions (Singbhum) the Working Plan of 1919 for the former Division, prescribed complete protection for areas under regeneration and early burning for the rest of the area. This was later changed to complete protection, and complete protection was adopted for the Saranda Forests under the new Plan. In Porahat complete fire protection has proved a failure. Despite all safeguards the whole forest area has been burnt over at least once during the past five years. It would appear that it would be preferable to concentrate on the protection of all regeneration areas, and if the surrounding forests had been burnt over early the regeneration areas from that fact would be safeguarded. In Sambalpur only young coppice coupes and regeneration areas are specially protected. A belt several chains wide round such areas is burnt over early in order to keep out later fires. This system has proved very successful. In the Puri Division the Bengal and Assam experience appears to exist and fire protection is killing out sâl regeneration. From the author's personal knowledge of some of the forests of this Province it may perhaps be held as proved that fire protection is, at least in the damper types, inimical to the establishment of sâl regeneration. Mr. J. W. Nicholson, the Provincial Research Officer, has laid out some plots with the object of ascertaining the effect on the soil of either annual or periodic fires. His views on the subject of early burning (incorporated in a letter, No. 107/8E—d of 31st January, 1925, to his Conservator), although dealing with a specific area, place the problem in a fair manner as it applies to many areas outside his own Province. He writes :

“ The advantages and disadvantages of burning may be summarized as follows :

A.—Effect on Soil Fertility.—*Advantages* : (1) Clay soils are dehydrated, thereby becoming ameliorated in texture. (2) Bacterial activity is promoted. (3) Potash is rendered more available. (4) Mineral salts and alkalis, promoting nitrification,

are provided from plant residues. *Disadvantages*: (1) Loss of nitrogen. (2) If the fire is too severe clay soils will become vitrified and the ash alkalis dissipated. *Conclusion*: The general effect of burning on clay soils, at any rate, may be considered favourable, and on other soils at least temporarily beneficial. The loss in nitrogen is likely to be made up rapidly. The soil is only likely to be excessively heated when there have been dense piles of material burnt, and such dense piles will be the exception rather than the rule." The latter allusion is to the beneficial effect of burning the waste refuse left behind in felled areas where there is no sale for it, which is, of course, a serious fire danger.

"B.—Effect on Regeneration.—*Advantages*: (1) Burning should have a greater stimulating effect than cutting back in inducing rapid growth of new shoots as the soil is temporarily more fertile. This effect should be most marked in seedlings struggling to become established. (2) The new shoots are forced up from the ground level or below the ground level and are therefore likely to be superior to shoots produced from above ground level, as sometimes produced when cut back. (3) The burning will char, i.e. sterilize the stumps from which the shoots are produced and fungal attacks should be negated. (4) Insect life will be destroyed, thereby reducing possibility of damage from insects." Nicholson is perhaps a little too optimistic in this statement, but generally speaking in this respect burning would be beneficial. "(5) The burning of debris will permit of regeneration shooting up which would otherwise have been kept suppressed. (6) It will temporarily destroy weeds through which, cut back regeneration would have had to struggle. *Disadvantages*: (1) Burning may actually kill a certain amount of regeneration. (2) It may injure the superficial root system. *Conclusion*: The advantages of burning seem to be distinctly greater than the disadvantages. As the whole of our older forests have grown up from seedlings burned back by fire it does not appear that fire can be seriously injurious to them.

C.—Effect on Forest Management.—*Advantages*: (1) Burning is likely to be very much cheaper than cutting back. (2) The risk of subsequent injury from fire will be enormously lessened by the preliminary burning. *Disadvantages*: (1) Burning will have to be carried out with care so that the fire does not spread outside the coupes. (2) Where groups of young poles have been left care will have to be taken to exclude the areas of such

poles from the effects of the fire. *Conclusion* : The advantages of burning seem far greater than the disadvantages, especially as groups of young poles have very rarely been left."

Central Provinces.—The 'early burning' of forest areas, instead of rigid fire protection, gave rise to conflicting opinions in this Province, and the new method does not appear to have made any progress until 1922-3. Its acceptance or trial may have been due partly to the considerable acts of incendiarism which took place in the forests whilst 'non-cooperation' was at its zenith and partly to its advocacy by Sir Henry Farrington after his appointment to the Chief Conservatorship. The adherents to rigid fire protection had certainly a strong card to play in pointing to the wonderful results produced in the Bori Forest—the first forest to be successfully fire protected in India (I, p. 224 ; II, p. 397). Farrington thus deals with fire conservancy in the Annual Forest Report for 1922-3 : "The total area for which special measures of protection (from fire) were taken was 9235 square miles against 10,290 square miles last year. The decrease of 1055 square miles is shared by all Circles and is partly due to new schemes of protection introduced in Nagpur-Wardha and North Raipur, but chiefly to the transfer of considerable areas, previously under regular fire protection, to the 'early burnt' category. The area successfully protected was 93 per cent as against 88 per cent last year, of the total area attempted ; the cost of operations being Rs.12.8 per square mile in the Southern Circle, Rs.11 in the Northern and Rs.4.15 in the Berar Circle. . . . The early burning idea has been given extended scope during the year in all Circles. The Conservator, Northern Circle, reports that the system works satisfactorily and prevents serious damage by later fires, while the Conservator, Berar Circle, considers that it is not applicable to forests containing species other than teak. The Conservator, Southern Circle, says that fully stocked middle-aged woods suffer no bad effects from early burning but regeneration is invariably burnt back to the ground. *Dhaura* (*Anogeissus latifolia*) is one of the worst sufferers in any fire." Farrington continues : "It is certain that the effect of late fires will be minimized when they extend to areas burnt earlier in the year. Of the Divisions seen by the writer the work had been most thoroughly done in Melghat and Hoshangabad, and done in good time too, which was not the case universally ; burning in a teak or mixed forest in March can hardly be termed 'early.' It will take

some time yet and involve rather special efforts on the part of Divisional Officers to get their subordinates to appreciate the fact that this burning must be done by degrees, taking the drier forests first, and as early in the year as possible, and not left till so late that uncontrollable fires result. It should be possible for the operation to be completed by a certain date to be fixed by the Divisional Officer, and subsequent fires in areas then under protection must be recorded as such and not included in the early burning record."

The Punjab.—Fire protection in the Punjab presents some points of interest. In 1900-1 an area of 581,411 acres was protected, the percentage of failures being 0.60 only. In 1923-4 the protected area amounted to 779,041 acres, out of a total acreage for the Province (Reserved, Protected, Unclassed and Leased Forest) of 3,965,576 acres, the percentage of failures amounting to 0.42. In their Review on the Report for this latter year the Punjab Government wrote ("Proc. For. Dept.," No. 851, Forests, dated 13th January, 1925): "The complete absence of forest fires due to malicious causes is a very welcome feature of the year's working and proclaims the better relations that now exist between the Department and the people. This is especially noticeable in the Rawalpindi *chir* forests, which were practically immune from fire throughout the year." The methods of protection employed were cleared fire lines, burning pamois (grass areas), employment of fire patrols and departmental firing of the forests, i.e. "early burning." The cost per square mile successfully protected was Rs.4.11.7 in 1923-4.

The Punjab Government allude above to the Rawalpindi *chir* (*Pinus longifolia*) forests. The protective methods in force there may be briefly summarized from a Report dated 25th January, 1925, by Mr. J. E. C. Turner, a Deputy Conservator of the United Provinces in charge of one of the Kumaun Divisions. Turner was deputed by his Government to visit the Rawalpindi East and West Divisions to study the methods in force of controlled departmental burning of the *chir* (*Pinus longifolia*) forests under resin tapping, and of areas which are neither under the latter nor under regeneration. The firing of areas under resin tapping in America is well understood and practised. The controlled firing of areas under resin tapping in the Rawalpindi *chir* forests has been in force since 1915 and forms an important part of the prescriptions of the Working Plan. The areas to be burnt each

year are definitely laid down. Areas under resin tapping are usually burnt every third year, the object being to get rid of the thick undecomposed inflammable mass of the long needles of this pine which accumulates on the forest floor. The three-yearly burning is advocated for the following reasons: (1) There is a sufficient accumulation of needles, grass, etc., to enable a clean burning to be made. (2) The soil covering and humus is not subject to so much damage as would be the case if annual burning was resorted to. (3) A three-yearly firing rotation enables the Department to more easily provide for the requirements of the people for fodder, grass and pine needles. The latter are used in roof construction in the Rawalpindi Hills. In this Province the work is done by free labour, the villagers performing it in return for rights and concessions granted to them within the forest area. This controlled firing of the forests is carried out in the winter months, from December to about the end of February, when the weather permits. December is the best month, as it gives time for the lips and pots for the ensuing season's resin work to be affixed to the trees. It is essential that the bases of all trees being tapped should be freed of all inflammable material prior to the burning. Turner thus describes the firing work: "The working-party was divided into two gangs; one went ahead and cleared all bushes, grass, needles and accumulations of resin round the bases of trees under tapping to a distance of about 4 feet round each stem, the other gang started the fire from a well defined and safe feature, such as a road or a ridge. The latter party exercised the greatest care to see that (1) not too wide a strip was taken up at one time; for this purpose the width was restricted to about 50 to 75 yards, running from spur to spur or from nullah to nullah. (2) The fire moved downhill regularly and in a horizontal line." This latter point is, of course, a vital one in any fire being carried downhill. The only possibility of effective control is to see that the fire does not get away in any spot; care has also to be exercised to see that burning cones do not roll down the hill and so start an *uphill* fire. If the work is done effectively and the bases of all trees being tapped are cleared from inflammable debris the resin channels or blazes rarely catch fire; when the latter occurs handfuls of earth should be thrown on them. Heaps of resin at the base of the trees, the result of several years' drippings, must be looked out for and dug up and removed. Turner states that "when under control, as it should always be,



THE FIRST EXPERIMENTS IN DEPARTMENTAL FIRING IN CHIR (*PINUS LONGIFOLIA*) FORESTS IN 1912. PUNJAB
H. M. Glover, photo.



EFFECT OF GRAZING ON REGENERATION OF *PINUS LONGIFOLIA*. ABOVE THE PATH IS OPEN TO GRAZING
 NO ADVANCE GROWTH. BELOW THE PATH CLOSED TO GRAZING. GOOD ADVANCE GROWTH OF YOUNG PINE

the fire does not travel rapidly downhill and, consequently, requires much encouragement. For this purpose the men along the line are engaged most of the time in fire tracing along the contour about 6 to 10 feet below the actual line of fire. In this manner the fire is gradually taken downhill, the firing party, as a whole, remaining along the same line horizontally. The operation is undoubtedly one that requires much patience." At the end of the day's operations the fire is extinguished. Experience has shown that a gang of twenty men can safely cope with a strip of forest about 50 to 75 yards on a moderate slope. Five or six of the men go ahead and clear the bases of the trees, the remainder attending to the firing work. Such a gang will burn about 75 to 100 acres. The work is usually controlled by the Range Officer, and he brings in one or more Forest Guards from adjoining beats to help in the supervision ; but a Guard is never placed in supreme charge, the work being too important. The above refers to areas under the method of light continuous tapping. In compartments under heavy tapping (the Working Plan prescribes the Shelter Wood Compartment System), the clearing at the bases of the trees requires special attention as such trees are very inflammable. The chief dangers to be guarded against have been found to be two in number : (1) On fairly steep slopes there is a tendency for the fire, sooner or later, to become an uphill, and therefore a dangerous one. A larger gang must be employed where this is the case. (2) On gentle easy slopes carelessness is shown and incomplete burning results, the second trouble, according to Turner, being commoner than the first. All areas which are neither under resin tapping nor regeneration are treated in the same fashion save that it is not necessary to clear the bases of the trees except to remove dry logs which, owing to their smouldering propensities when well alight, would prove a source of danger.

The controlled firing of regeneration areas has not yet been undertaken in the Rawalpindi Divisions. An experiment of this nature was undertaken by Turner and Mr. R. M. Gorrie, the Divisional Officer of Rawalpindi East Division. The last paragraph of Turner's Report is worth transcribing : " Early in my tour, while standing on a peak surveying the Rawalpindi Forests and drawing a general comparison with those of Kumaun, I was struck by the absence of fire lines which are so conspicuous in the latter, where nearly every prominent ridge or a spur has a fire line running along or

down it. Only cleared narrow compartment lines about 20 feet wide are noticeable in the Rawalpindi Forests. With the system of controlled firing in force, which reduces the possibility of fierce incendiary fires in the hot weather to a minimum, there is no necessity of having broad fire lines. Thus the initial cost of making fire lines (about Rs.100 per mile in Almora), as well as the annual recurring expenditure on clearing and burning them, are avoided. If we could effect similar economy in Kumaon the sum thus saved could profitably be diverted towards meeting the cost of controlled firing in our regeneration areas."

The United Provinces.—Before dealing with fire protection in the United Provinces generally the question of applying the Rawalpindi controlled firing in the *chir* pine forests to those of a similar character in Kumaun may be disposed of. The Kumaun Forests had remained under the Civil Authority until 1915, when the greater portions were constituted Reserved Forests and came under the management of the Department. As in many other parts of India where Reserves were created, the Government policy, though essential if the forests were to be conserved, met with opposition, and perhaps rigid fire protection was one of the measures most disliked. Under the cooperative movement the more lawless of the population were fanned into open activity and very large areas were burnt in 1921 with devastating consequences to the forests, which will take years to repair. No censure is too strong to pass upon those responsible, either actively or passively, for such wanton destruction, all the more serious when coniferous forests are in question. The forests belong to the people, are managed in their interests and in the interests of their posterity. The senseless and ignorant destruction of 1921 is comparable and on a par with the stupid excesses which occasioned great damage to forest property in Russia after the revolution in 1917, some instances of which the author had the opportunity of personally witnessing. It might have been hoped that a century of orderly British rule and sixty years of a high type of forest management, which was the proud boast of the United Provinces, would have rendered such a calamity an impossibility. But the position would be even worse were the Government to reverse its decision and leave the magnificent *chir* forests of Kumaun to an inefficient management which would eventually result in their disappearance. The soft wood (i.e. pines, firs, etc.) forests of the world are nowadays

far too valuable, and must, with ever-increasing demands, have a higher value, for such a policy to be anything but deplorably retrograde. As has been said, the objection on the part of the people, is to fire protection ; the forest floor becomes coated with a thick mass of undecomposed needles on which their cattle slip on the steep slopes, with perhaps a broken leg or a fall over a precipice as a consequence. The thick mat of undecomposed pine needles also prevents a sufficient and early crop of new grass springing up for the cattle. The Department intend to introduce the controlled burning as practised in the Punjab, and if this step proves successful it should lessen the tension between the people and the Department which has had such calamitous results in recent years and has always rendered the problem of getting up young natural regeneration of the *chir* pine a purely fortuitous matter. Even when a promising young plantation had been obtained a fire would sweep it out of existence and a labour of years be wiped out in a few hours. The keenest Sylviculturist could scarcely be blamed for losing enthusiasm under such conditions. Turner writes: " Being often driven to a choice between incendiary fires by the Kumaun villagers during summer and controlled burning by the Department during winter, I have no hesitation in deciding on the latter *as the lesser of two evils*. The harm done to *chir* pine forests in the case of the former is colossal and sometimes almost irreparable, while the damage under the latter is comparatively infinitesimal. Under a scheme of departmental firing, which will maintain the forest floor in a far less inflammable condition than hitherto, the awful devastation of the year 1921 can never be repeated."

As has been mentioned, controlled firing in regeneration areas has not yet been attempted in Rawalpindi. Experiments are to be conducted to ascertain whether this form of protection can be introduced without endangering the vitality of the young trees or injuring the soil.

Early burning is being tried in connection with the *sâl* in Haldwani, Dehra Dun and elsewhere. The work is still in an experimental stage and will be dealt with in the sylvicultural chapter. The total area in which fire protection was attempted in the Province was 3695 square miles in 1923-4, the cost being about Rs.25 per square mile. The methods of protection in force have been fully described in earlier parts of this history. In the North Kheri Division a telephone system has been introduced and has been found very successful. It links

up the Ranger's headquarters with the stations of the fire watchers.

The Bombay Presidency.—Fire protection in this Presidency has had a somewhat chequered history, and it was at a comparatively late period that a properly organized system of fire lines was developed and fire patrols introduced. The year 1920-1 was a year of bad fires, over half a million acres having been run over by fires out of a little over 6½ million acres attempted to be protected. In the following year early burning was introduced in the Southern Circle with success, and the method is now being brought into the Northern and Central Circles, where experiments have proved successful. In the Southern Circle early burning is done in December-January, and in Thana in November-December. The operation is only carried out once and the fire is allowed to run into the Reserve. Early burning has also been tried in closed coupes in the Southern Circle. Plantations and regeneration areas are rigidly fire protected. As will be common in all parts of India where grass is cut and extracted from the forest for fodder or other purposes the burning of such areas can only take place after the removal of this produce. In Khandesh the collection of Rosha grass for distillation is a valuable source of profit and early burning of these areas only takes place on completion of the cutting and extraction of this produce.

The Madras Presidency.—Until recently the system adopted in the matter of fire protection generally in Madras consisted in the clearance and maintenance of fire lines, and the employment of special fire patrols. The present practice is thus described by Mr. H. Tireman, the Chief Conservator of Forests. "This system has proved ineffective and the system of early burning under departmental supervision has been inaugurated in recent years and is being extended wherever practicable. The system consists of setting fire to the grass, as soon as it is dry enough to burn, the resultant fire being much less severe than if it occurred later in the season and doing very little damage; the cost of the work is appreciably less than that of the old system of attempting to prevent fires. Indirect methods of fire protection applied by the Department consists of a system of rewards to subordinates who have shown good protection work, rebates of grazing fees in respect of village forests found to be free from fire and closure of burnt areas to grazing. The system of rebate of grazing fees has been tried with satisfactory results in several parts of the Presidency.

The provisions of the Forest Act also indirectly help in securing the immunity of the forests from fire. Section 27 authorizes the closure of forests to pasture and other privileges as an additional punishment for incendiarism, while under Section 23 it is obligatory on every person enjoying any privileges in a reserved forest and on every village officer to intimate the occurrence of fire and to render help in extinguishing it."

It will become apparent from the above résumé of the opinions held and methods employed in the various Provinces that what has been termed a revolution has occurred in this important matter of fire protecting the forests. The Government of India warning that enthusiasm for the new ideas should not lead the Forest Officer to form the opinion that fire protection in any form is a waste of money comes in time. From personal observations the author has been able to carry out, it is easy to see that the pendulum might easily swing too far. In every Circle and in every Division or part of a Division the advisability of early controlled burning must be decided on its merits by the officers on the spot. The obvious and very decided advantages to be obtained in the contentment of the people and the getting quit of a most harassing form of work by the forest staff, must not be allowed to weigh against the effect of the operation on the forest crop. This being said, from the experience already gained, it would appear that fire may prove one of the most useful allies of the Sylviculturist in obtaining the successful regeneration of his areas in the case of some species, and to the Protection Officer in ridding him of dangerous pests.

CHAPTER XVI

THE PROGRESS OF SYLVICULTURE IN INDIA AND BURMA 1901-25

THE Forest Officer who has been away from India a decade or even less would find it difficult to realize the great progress which has been made in the silvicultural treatment of some of the best-known Indian species. Nor would he be able to appreciate, without visiting the areas, the advanced nature of the work now being undertaken in many of the Provinces. Having passed the whole of his Service in managing forest areas under the so-called Selection System by the equally so-called Improvement Fellings, which, as is now very thoroughly realized, did little more than remove the marketable individuals of a few species from the mixed crop—to such a man the mere mention of the fact that areas are managed under concentrated regeneration fellings, by *taungya* or otherwise; under the uniform or shelter wood compartment system, either by natural regeneration or artificial work; or by combinations of this method with strips or groups; under coppice or coppice with standards, would convey little. With the fixed ideas engendered during a life's work carried out on the one basis it would prove difficult to visualize the present great advance; to appreciate that at the present day work on as high a plane as anything on the Continent of Europe is to be seen in India. It is true that such a statement must be qualified, and necessarily qualified, by the proviso that these methods have been so far only applied to a comparatively small percentage of the forest area; nor does their application indicate that India is as yet in a position to afford to the Forest Probationer as valuable a training-ground as exists in Europe. For with the exception of a few plantations no Indian forest has yet passed through a whole rotation, much less several, as is the case on the Continent of Europe; and therefore the many object lessons for the student are inevitably absent. But in this chapter the case of the

student does not primarily come into the question. It may be argued that the Indian Forest Service now issues a number of exceedingly able and informative reports and, in addition, that many of the Working Plans drawn up for forest areas are on as high a level as is to be found in any other Service in the world. This is the case. But the ablest reports, monographs and treatises cannot take the place of ocular demonstration; and more especially perhaps where forestry is concerned. And Government Annual Reports nowadays, in their abbreviated form and multitudinous statistics, are dry bones upon which it is almost impossible to clothe any lucid account which would be either informative or likely to hold the attention of the enquirer. It was this realization which obliged the author of this history either to bring it to an abrupt termination or to revisit India. It proved a most illuminating visit.

In Volume II, Chapter XVIII, the progress in sylviculture and the position achieved at the end of last century was portrayed, based on the opinions held by Ribbentrop, then Inspector-General, and it may be surmised the Senior Officer of the Department.

Before reviewing the progress of the present century a summary of the break away from the old Selection System in the different Provinces is necessary.

Bengal.—Clear felling has been introduced into Northern Bengal, and practically all clear fellings are restocked artificially by *taungya*. The cost of formation in 1924-5 averaged Rs.15 per acre against Rs.22 in 1923-4. The cost of an established plantation being from Rs.25 to Rs.30 per acre. It is expected that plantations of "gamari" (*Gmelina arborea*) will mature in thirty years and be worth at present prices Rs.2000 per acre, and those of sâl, the slowest grower, at eighty years and be worth Rs.5500 per acre, both at present prices and taking no account of the intermediate yields from thinnings. In the Sundarbans natural regeneration of all the principal species is adequate, as it always has been. In the Chittagong Divisions successive regeneration fellings, which aim at establishing "garjan" (*Dipterocarpus turbinatus*), have been recently introduced. Where coppice has been relied on they appear to have been satisfactory. In the rest of the forest area under the Selection System climber cutting and improvement fellings and thinnings are in force, and are carried out with such detail as the strength of the staff permits.

Assam.—The old method of improvement fellings with

climber cutting is still in force in Assam. In Goalpara only has the modern method of improvement-cum-selection been introduced—chiefly in the Guma and Central Ranges. Clear felling and *taungya* regeneration have been introduced in recent years in the Sylhet and Cachar Divisions, and experimental sowings after clear felling in the Sadiya Division on a small scale.

Burma.—The chief system of concentrated regeneration in Burma at the present time (1925), as will be described later, is the *taungya* method. In some instances regular plantations are formed, whilst the rest of the forest areas are under improvement-cum-selection operations. The following figures of cost show how considerable has been the increase in the concentrated regeneration work : 1900-1—Sowing and planting, Rs.60,570; Improvement fellings, climber cutting, etc., Rs.74-118. 1910-11—Sowing and planting, Rs.69,307; Improvement fellings and thinnings, etc., Rs.116,560. 1923-4—Sowing and planting, Rs.138,760; Improvement fellings and thinnings, etc., Rs.60,767.

Bihar and Orissa.—Until 1919 the systems in force were either the Selection or Coppice with Standards. The Uniform System has been introduced into the sâl forests of the old Singbhum Division, the areas of forest not included in the Regeneration Periodic Block being worked under the Selection System with Improvement Fellings and Thinnings. The Uniform System or modifications is being applied to other important forests. Coppice on rotations of from twenty to fifty years is prescribed in Sambalpur, where a part of the area is under the Strip System.

Central Provinces.—The forests of the Province are in a transition stage. Early in the century the Coppice with Standards System was introduced over large areas. After ten to twenty years' work the system was found to be inapplicable to extensive areas. The forests had greatly improved in younger age classes after fifty years of protection. The working now introduced is careful Improvement fellings with cleanings and thinnings combined with the removal of the old standards. In the South Raipur Forests the Uniform System is prescribed under the new Working Plan. The Allapilli and Bori Forests were not placed under Coppice with Standards and will be referred to later on. *Taungya* regeneration has been introduced into Bilaspur. In the Buldana Division profitable fuel plantations of *babul* (*Acacia arabica*) are



EFFECT OF THE FROST OF 1905 ON SĀL POLES AS SEEN 6 YEARS LATER. TIRSAL FORESTS, SIWALIK
DIVISION, UNITED PROVINCES. PHOTO. 24 NOV., 1910

Photo. by C. B. Chitrakar



EUCALYPTUS GLOBULUS COTTAGE. OOTACAMUND, NILGIRIS. MADRAS PRESIDENCY

Photo, by R. S. Tronp

worked by the Department, this species attaining 30 feet in height and 20 inches in girth in twenty-five years.

Madras.—In the Forest Administration Report for the Quinquennium ending 1923-4 the Chief Conservator of Forests has the following remarks : " The quinquennium has witnessed a great advance in silviculture, a subject which in Madras had not previously received the attention which was due to it. Improvement Fellings and the so-called ' Selection System ' have been practically done away with in all important forests in favour of regeneration under the system of Clear Fellings. When exploitation of the evergreen forests was first undertaken it was feared that regeneration would be a difficult matter, but experience shows that the problem is likely to be of easy solution owing to the abundance of natural regeneration which can easily be supplemented by sowings." The system is really a modified Uniform one, since in S. Kanara sowings of *Hopea parviflora* have been undertaken under the shade of a deciduous crop. Fuel coupes are worked under Coppice, Nilambur plantations under Clear Felling and artificial planting, the Mount Stuart Forests with artificial sowings of teak, etc., after Clear Felling. The Gumsur Forests are under a modified Uniform System.

Bombay.—Early in the present century, as in the Central Provinces, the Coppice with Standards System was prescribed over considerable areas. This proved unsatisfactory and the systems now in force are : (a) Over the larger part of the High Forest the Selection-cum-improvement Fellings is prescribed, comprising the felling of old marked teak, the removal of old hollow trees and miscellaneous material, and thinnings in the younger-age classes. (b) Teak pole forest is worked under the Coppice System supplemented by planting and sowing of teak as, e.g. in parts of North Kanara, Dharwar and Bijapur, and also in Thana. (c) Clear Felling followed by sowing and planting in the teak High Forests of Kanara, Belgaum, the Dangs and Peint. Also in certain *babul* and *Casuarina* areas.

United Provinces.—Previous to 1910 the bulk of the more important sâl forests were managed under the old Selection with Improvement Fellings. Some of the more accessible forests were treated under Coppice with Standards, while further areas of poor quality were simply under Improvement Fellings. In 1910 the Motipur Forests (Bahraich) were brought under the Uniform System with but partial success. In 1914 Collier included all the Bhabar and Terai Forests of the

Haldwani Division in a "conversion to uniform" Working Circle with six periodic blocks of twenty years each. In the same year Clear Felling and Coppice was introduced in Gorakhpur. The Uniform System with modifications spread to other Divisions including the hill forests, whilst in Gorakhpur the *taungya* method of regeneration was employed in areas where there was an absence of advance growth.

The following shows the area in square miles under different systems in 1923-4 :

Clear Felling	Uniform System	Selection System	Selection cum-improvement	Coppice with Standards	Improvement	Protection (Unregulated Fellings)	Total
87	1330	483	932	316	482	993	4673

Punjab.—Up to 1907, when Mr. C. P. Fisher was appointed Conservator, the valuable hill forests were worked under the old Selection System. It had already been recognized by Lace, Hart, McIntire, Fisher and others that the system was unsuitable. The matter was discussed at the Forest Conference (assembled by Fisher) at Lahore in 1908, of which the writer was a member. After considerable discussion it was proposed to introduce the Group System in the Plan for the Chamba State Forests. This proved unsatisfactory and subsequently the system adopted for all coniferous species in the hill forests was the Uniform or Shelter Wood Compartment, which is now the recognized system for these forests. The irrigated plantations in the plains are, or will be, managed under the Coppice with Standards System.

The following shows the area in square miles under different systems in 1923-4 :

Uniform System	Selection System	Coppice with Standards	Improvement Fellings	Unworked or other Fellings	Total under Working Plans
419	22	150	164	1483	2238



TACUNGIA CUTTERS DIBBLING PADDY IN THEIR PLOTS IN THARRAVADDY DIVISION. THE MEN NOTCH THE SOIL AT INTERVALS OF A FEW INCHES, USING THE LONG BAMBOOS WITH IRON CHISEL-SHAPED TIPS AND WORKING WITH THE BALANCE OF THE LONG POLE. THE WOMEN SOW PADDY IN EACH NOTCH. PHOTO.

JUNE 1921

Photo. by H. K. Blanford



TEAK SOWN BROADCAST ON LEVEL GROUND AND TRANSPLANTED TO STAKE. SHOWS EXCEPTIONALLY VIGOROUS GROWTH WHERE NO PADDY HAS BEEN SOWN. PHOTO. TAKEN DECEMBER, 1921 OF THE 1921 JULY COMPT. 8 MINILA RESERVE, THARRAWADDY DIVISION, BURMA

The progress of the work in the several Provinces will be considered under the Sylvicultural System and modifications adopted.

I. TAUNGYA PLANTATION WORK (IN CONJUNCTION WITH FIELD CROPS)

One of the first methods, if not the first (omitting plantations pure and simple), of regenerating the forests to meet with practical acceptance was the plan of making use of the custom of shifting cultivation which was suggested by Brandis in Burma in the middle of last century and is now commonly known by its Burmese name of *taungya*.

1. *Taungya Plantation Work in Burma*.—It has been already shown that the *taungya* plantation work in Burma up to the beginning of the present century had never been organized. The *taungya* cutters, with a few restrictions, were allowed to cut their *taungyas* wherever they pleased on the condition that they put in the teak plants provided by the Department during the period they raised their crops on the area. The consequence was that the teak plantations so made were scattered over wide areas with no attempt at concentration, with the inevitable consequence that adequate supervision and tending was impossible (II, p. 568). The late Mr. J. H. Lace, in his Annual Report for the Pegu Circle, 1904-5, appears to have been the first to draw official notice to this state of affairs. His remarks attracted attention and the Government of Burma issued a resolution in 1906 which, save in specified cases, put an end to the indiscriminate formation of teak plantations by the *taungya* method. Their action at the time was correct, but the condemnation of the *taungya* method, solely owing to the inefficient organization on which it was employed, was unfortunate.

From 1906 the procedure ordered was to concentrate on the work of Improvement Fellings under the Selection System which later were classified into the "O" and "Y" types of Improvement Fellings. This policy was reaffirmed by the first Forest Conference held in Burma in 1910, with the modification adopted to meet the views of some of the members that the Tharrawaddy Working Plan should be redrafted on the concentrated method. From 1909 the first attempt at working a forest under concentrated regeneration was commenced in the Mohnyin Working Circle of the Katha Division. The initial efforts were confined to an endeavour to obtain natural

regeneration. This did not meet with a marked success, and *taungya* work was subsequently added. Later on it was realized that in the absence of seed-bearers in sufficient numbers artificial regeneration would have to be resorted to in order to obtain complete stocking. The work carried on at Mohnyin and its results provided valuable object lessons which were not lost on the Department, and what may be termed the new era in the correct utilization of the *taungya* method for concentrated artificial regeneration came in with the Tharrawaddy Yoma Working Plan in 1918. The systematized method spread to other Divisions, Zigon and N. Toungoo and elsewhere.

The *taungya* method of concentrated regeneration fellings necessitates the presence of an adequate labour supply which, in its first conception, was provided by the jungle tribes addicted to shifting cultivation, and is applicable to areas in which the forest can be clear felled without the danger of the young tree crops suffering from frost or excessive drought ; it usually presupposes a sale for the material from the clear felling. These factors, therefore, quite clearly limit the regeneration of the forest by this method, although adaptations are not impossible to the skilful Forest Officer. Where labour is not available, as in some parts of the country, the difficulties may become serious. Here it would seem the solution may be found in the formation of the true type of forest village, a type of labour inured to the jungles being imported from other parts, on lines similar to those on which tea gardens have for long recruited their labour force. In fact, with the probable wide extension of the *taungya* method of regeneration it would not improbably prove a wise step to employ for a few years a Forest Officer as a recruiting agent ; such an officer would carefully select the labour required from people accustomed to the climate and life of the forests.

It has been said that the natural regeneration prescribed under the Mohnyin Working Plan proved unsuccessful. In 1917 the method was therefore changed and the *taungva* system of artificial reproduction was resorted to over a considerable part of the area. In other words, the method condemned in 1906 came back again and came to stay. North Toungoo had successfully introduced the natural regeneration method first adopted in Mohnyin. The work carried out in these two Divisions may be said to have paved the way for the more general introduction of the Clear Felling System, and



TEAK PLANTED 6 FT. \times 6 FT. IN 1911. PHOTO. TAKEN NOV. 1915. COMPT. I,
BILUMYO RESERVE, KATHA DIVISION, BURMA

Photo. by H. R. Blanford



A 1920 PLANTATION PLANTED WITH TEAK 6FT. X 6FT. WITH BROADCAST AND NATURAL *BINGA* (*STEPHEGYNE DIVERSIFOLIA*). PHOTO. TAKEN DECR. 1921. SHOWS EXCELLENT GROWTH OF TEAK OVER *BINGA* WITH ENTIRE FREEDOM FROM WEEDS AND CLEAN SOIL. COMPT. 9, MINHIA RESERVE, THARRAWADDY DIVISION, BURMA

Photo. by H. R. Blanford

the commencement of the work at Tharrawaddy soon led to the adoption of the method over a much larger area.

The experiments in regeneration made at Tharrawaddy in 1918 finally demonstrated that *taungya* plantations were easily the cheapest and most efficient method of regenerating the teak forests, or certain types of teak forest, in Burma. The area laid down for regeneration under the Plan, calculated as 1/120th of the total area considered suitable for teak, was 1000 acres, but later it was found necessary to reduce the area to 600 acres as the removal of all the marketable timber could not keep pace with the regeneration of the larger one. This difficulty was also experienced in Zigon. In the latter Division it was found necessary to leave the more inaccessible forests in the north to be worked under the Selection System. In the North Toungoo Division considerable progress was made. The activity with which this work was taken up is demonstrated by the fact that on June 30, 1924, the area of *taungya* plantations was 98,740 acres, showing an increase of 20,000 acres in the preceding six years as compared with an increase of only just over 1000 acres under *taungya* plantations in the preceding eleven years.

The earlier *taungya* plantation work was practically confined to teak and cutch (*Acacia Catechu*), of which there were 58,000 acres in 1901. In 1916 attention was turned to the question of planting other species, and a considerable number were tried at Tharrawaddy under the new plan. The present policy, a sound one, is to plant the species which is considered most suitable to the locality, those chiefly used at the present time, other than teak, which is put out on all suitable areas, are *pynikado* (*Xylia dolabriformis*), *taukkyan* (*Terminalia tomentosa*), *padauk* (*Pterocarpus macrocarpus*) and several others. Much of the new work at Tharrawaddy was carried out by Blanford (now Conservator of the Working Plan Circle, but then Divisional Officer). To Blanford the writer is indebted for much of the above information, and also for the privilege of examining in his company the magnificent series of young plantations now to be seen in this famous Division. With what pride Brandis, the founder of Tharrawaddy (I, pp. 380, 381), would have regarded this great work.

Until recently regeneration or improvement work had been confined to teak areas. Increasing attention is now being paid to other types of forest, e.g. the type characterized by a predominance of "In" (*Dipterocarpus tuberculatus*),

and generally to accessible areas with a view to providing fuel, etc.

The *taungya* method has now been extended to the valuable though small areas of plains forest lying between Tharrawaddy (p. 62 *ante*) and Rangoon, now engulfed in a sea of cultivation. (*Vide* in this connection Government of Burma Resolution in Proc. For., No. 81, I, 24, dated 30th June, 1924, on "Reservation for purpose of providing timber for domestic consumption in heavily populated areas.") Labour is, of course, no trouble here, and the villagers raise valuable crops of sugar cane and paddy with a mixed forest crop of trees which will provide the future supplies of fuel, etc., for the local population. The Department demands a high percentage of success in the trees raised.

As indicating the changed conditions in Burma, it will be remembered that the former idea was to take advantage of a general flowering of bamboos in teak areas and broadcast teak seed (II, p. 583). For years such a flowering was awaited. Blanford writes (1925): "Nowadays we look upon bamboo flowering as a curse rather than a blessing, as it holds up *taungya* regeneration for many years until the bamboo is sufficiently mature to be cut over by *taungyas*."

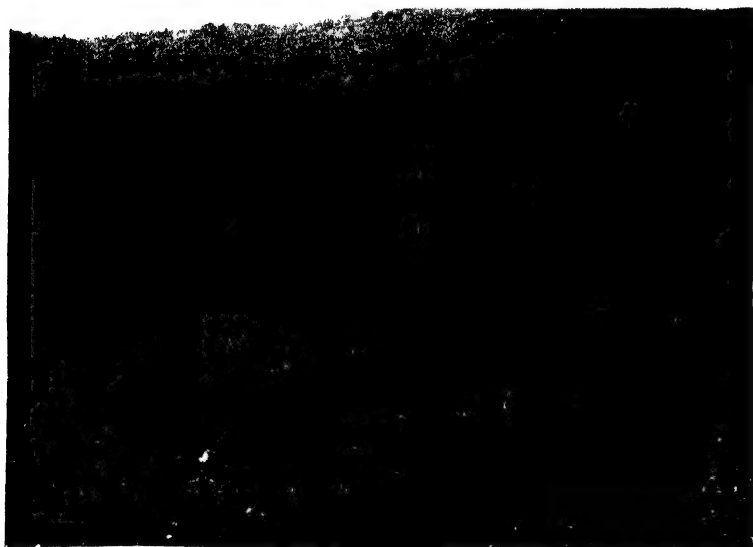
2. *Taungya Plantation Work in Bengal*.—To the Forest Officer who served in Bengal in former days the present position of the Province in forestry matters is most gratifying. From being one of the most backward, parts of the Province have now assumed a position in the van of forestry progress, a position which is ungrudgingly accorded to it. Blanford, after visiting the *taungya* work in Bengal, in January, 1922, wrote (Burma Forest Bulletin, No. 5): "In most respects the work carried out is better organized than in Burma." This position has been attained as the result of some epoch-making work.

The *taungya* method was not unknown in Bengal. The Kaptai teak plantations in Chittagong, which were blown down in a cyclone in October, 1897, were formed by this method as long ago as 1877 (II, p. 572). They were only restarted in 1912. By 1924 the plantations totalled nearly 14,000 acres, and were the most successful in Bengal. The average girth of 1917 teak was 14 inches in the thinned and 11½ inches in unthinned plots. *Gambari* (*Gmelina arborea*) showed an average girth of 22½ inches in six years. This rate of growth should give a 6-foot tree in thirty years. The great need of the plantations, as was the case in the north, was proper thinning.



PYINKADO SOWN IN JUNE, 1921, ON RAISED MOUNDS ON WHICH SUGAR CANE IS CULTIVATED. SUGAR CANE IS BEING HELD BACK IN FOREGROUND TO SHOW THE *PYINKADO* (*NYLIA DOLABRIFORMIS*). THINDAWYO RESERVE, THARRAWADDY DIVISION, BURMA

H. K. Blanford, photo.



A 1917 TEAK PLANTATION SOWN 10 FT. \times 6 FT. PHOTOGRAPH TAKEN



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11
101



SAMPLE PLOT NO. 11 NEAR MOHNIT IN TEAK PLANTATION NO. 14 OF 1912. PHOTO, TAKEN JANUARY, 1923, JUST BEFORE THINNING AFTER FELLING SUPPRESSED TREES. KAING RESERVE, PYINMANA DIVISION, BURMA



TANU-I FLOWERED 1913-4. PHOTO, TAKEN NOV. 1916. SHOWS DEAD CULMS MOSTLY FALLEN² AND VIGOROUS REGENERATION OF TANU-I (*CEPHALOCYSTICHYUM PERGRACILE*). PILE RESERVE, KATHA DIVISION, BURMA

Photo. by H. R. Blanford



SOWN TEAK 6 FT. X 6 FT. WITH A DENSE NATURAL REPRODUCTION OF *IVORY LINDEN* (*CORDELLA*). NOTE
ABSENCE OF WEEDS. PHOTO, TAKEN JULY 1921 OF 1920 P.L. RAWBIN RESERVE, ZIGON DIVISION, NEAR
SANGYI

The present methods of forming *taungya* plantations in Northern Bengal are the result of experience gained partly by the Forest Department and partly by the Cinchona Department which, wrote Mr. E. O. Shebbeare in 1921, "has been systematically planting up forest after the removal of the Cinchona crop on the Muuphu Plantation for the last twelve or thirteen years at the rate of 250 acres annually. It is to Mr. Russell of the latter Department that we owe most of what we know concerning the work in the middle and foot hills as well as up-to-date nursery practice throughout." Apparently the two Departments began to introduce the growth of field crops as an aid to forming plantations, independently, at about the same time. In how far the Cinchona Department had authority to restock areas on which cinchona was no longer grown with forest crops appears open to doubt. Under the agreement signed in October, 1878, between the Conservator of Forests and the Superintendent of the Botanical Gardens, Calcutta, it would appear that, in any event, the revenue from them should be credited to the Forest Department (cf. p. 207 *ante*). Nevertheless, the results of this re-afforestation work are acclaimed on all sides as magnificent. Their nursery work had long been a household word in Bengal. The methods and practice were imported direct from Scotland and the results are therefore not surprising. The Department acknowledge their indebtedness to Mr. Russell in this respect. Blanford, in his above-quoted note, comments upon the fact that nursery work "has been so well developed in Bengal." The devious route by which the employment of the *taungya* method for the regeneration of *sâl* was arrived at in Northern Bengal will be briefly glanced at.

When fire protection was introduced into the *sâl* forests of the Duars, and for some years after, the forest growth consisted principally of *sâl* associated with a few fire-resisting species, the forest floor being covered with grass. Unperceived for a time, the character of the forest owing to fire protection gradually changed, a dense evergreen undergrowth killed out the grass, climbers became abundant and species susceptible to fire made their appearance. Towards the end of the last century and the beginning of the present one these factors became recognized and attempts were made in the Working Plans for Buxa and Jalpaiguri Divisions (1905-6) to assist natural regeneration, which was considered to be satisfactory in areas where the evergreen undergrowth was not too dense. Felling

rules were prescribed with the object of assisting all promising young sâl growth, and to aid the development of natural regeneration, light thinnings only being prescribed in the case of dense groups of young sâl poles. The Working Plans Officers considered that these measures, combined with the necessary cleaning and weeding at five-year intervals, would result in establishing an ample young crop of sâl. Attention having once been drawn to the results of fire protection in these moist sâl forests the question of continuing such protection was discussed, and in 1910, when it became apparent that the hopes of the framers of the Working Plans were not being realized, experiments in burning the areas, as also in artificial regeneration, were commenced. By 1914 the five-yearly cleanings were reported a failure. In an article published in the *Indian Forester* (April, 1914) by Messrs. Grieve and Shebbeare the position of the forests was thus described :

" In the wet type, established saplings or seedlings do not exist although, as before, yearly seedlings are of fairly common occurrence, especially on cleared lines and cart tracks. There is, unfortunately, every indication that the wet type is encroaching on the dry, owing, presumably, to the successful fire protection. In fact, it would appear that when the present crop of sâl is exhausted there will be no more to take its place. . . . An entirely new and unforeseen condition has arisen in the shape of evergreen undergrowth producing a hitherto non-existent type of forest. The phenomenal increase in the growth of climbers resulting from the exclusion of fire was also not anticipated." In an article on " Artificial Regeneration of Sâl " (*For. Rec.*, VIII, Pt. IV, 1922) Glasson remarks : " Conditions to-day are substantially the same as described above (by Grieve and Shebbeare) ; ground fires have been put through some of the sâl forest with beneficial effect to the existing crop, but without inducing regeneration, and in many places we are exploiting trees which came in after fire protection was established."

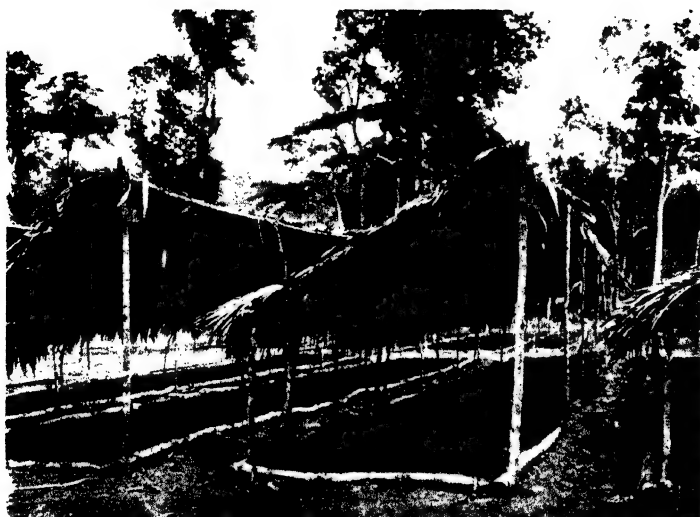
Even before 1910 a few experiments had been made with artificial regeneration of sâl, chiefly on grass lands and in abandoned village sites devoid of sâl. The only one of which detailed records exist is in North Muraghat, made in 1896-7-8. The land was good and fairly well drained, the sâl seed being sown in lines 6 feet apart. It was intended to cultivate field crops between the lines in the second year, but the villagers refused to undertake the work. The lines were cleaned up to



TEAK REGENERATION BY COPPICE IN SOUTH DANGS (NETMAL). 2 MONSOONS OLD. AVERAGE HEIGHT, 12 FEET. BOMBAY PRESIDENCY



TEAK REGENERATION IN SOUTH DANGS (GIRA). A PATCH OF TEAK PLANTATION. 4 MONSOONS OLD. AVERAGE HEIGHT 5 FEET. BOMBAY PRESIDENCY



GENERAL VIEW OF NURSERY BEDS IN BILUMYO RESERVE, KATHA DIVISION,
SHOWING DETAILS OF CONSTRUCTION ON THE SAME LINES AS ADOPTED IN BENGAL

H. K. Blanford, photo



TEAK PLANTATION PHOTOGRAPHED IN 1923 WITH RAHAR DAL PLANTED
KATHA DIVISION, BENGAL.



5-YEAR OLD *SAL. ZIUNGTI* PLANTATION NEAR RAJABHAT KHAWA, BUNA DIVISION, BENGAL. E. O. SHIFFEARE, CONSERVATOR

Photo, by Author



YOUNG *TILIACORIA* PLANTATION, WEEDED. NORTHERN BENGAL, 1925

Photo by Author

899. Records of growth were kept up to 1902 and then ceased. From observations made in 1915 the average girth and height of the best trees were 2 feet 5 inches and 70 feet respectively.* This experiment was discontinued in 1903, as it was still believed that the sâl was capable of regenerating itself, if aided by properly carried out Improvement Fellings and Cleanings. The next experiments undertaken were those of 1911 and 1912. These aimed at obtaining young sâl growth under a top cover, generally of *mallata* (*Macaranga*). Good generation was obtained, but the seedlings did not develop, and the only result of opening out the top cover was the production of a dense undergrowth which killed out the sâl. The ensuing attempt in 1913 was the sowing of sâl seed on ridges made on deserted village lands, the resultant crop being weeded as often as necessary. This was successful, but very costly, amounting to Rs.60 per acre. In the following year mounds 1 foot high and 2 feet square were tried, made at intervals of 10 feet. The results were successful at first, but the crop was lost, chiefly owing to pigs and rats. In 1915 the cost was cheapened by reducing the mounds to "sods" made 6 feet by 6 feet apart. Mound sowing was also repeated. The cleaning work was very costly, but it was considered that the method was successful. Up to now only abandoned village sites had been dealt with. As land of this nature was not abundant it was proposed to give out for cultivation areas likely to be suitable for sâl, but which at the time were only covered with inferior species. These areas were to be clear-felled and cultivated for four to five years until they were clean. Areas of this description were marked out in the Buxa Division, but were not taken up by villagers; later in this year an area in a cleared fuel coupe in the Jalpaiguri Division was cultivated by villagers. It became at once apparent that after only one crop of rice, cotton and sesammon had been taken off the land became absolutely clean, and it was obvious that it would not be necessary to cultivate for three to five years. In 1916 sâl was put out in the second year's cultivation in Muraghat (Jalpaiguri Division) and in first year's cultivation at Nimati and Poro (Buxa Division). The results at once eliminated

* The records of 1915 were made by Troup. In his *Sylviculture of Indian Trees*, under this plantation he quotes a tree as 2 feet 11 inches in 1915. Sir H. Farrington was engaged on the 1896 work as Assistant in the Division. He visited the area in 1926. In a letter to the author (17 Feb., 1926), he writes, "Troup's 2 feet 11 inches tree of 1915 is now 4 feet 10 inches. Sâl of 6-foot girth in under fifty years seems a certainty."

further trials with the mound and sod sowings owing to their cost and the recognition that it would be impossible to obtain sufficient labour for the necessary weeding for such operations carried out on a large scale. The *taungya* method had been slowly worked up to, and from 1917 onwards no other methods have been attempted. The cost incurred was high during the first few years, but has been reduced latterly, and it has never been as high as that of the other methods. The item which has increased the expense of the work in Bengal has been the necessity of fencing against pig, sambhar and cow bison. Round plantations in the Kurseong Division (Sukna) and also at Rajabhatkhawa wire fencing of much the same height as is used in Scotland to keep out deer is maintained. This consists of wove wire with two upper strands of barbed wire fixed to stout posts.

The work was started experimentally at the foot of the hills in the Kurseong Division in 1917-18 and the method has since been developed. The operations will be briefly described.

Sâl is only placed on suitable areas, the other species being grown consisting of *Gmelina arborea*, *Chikrassia tabularis*, *Bischofia javanica*, *Terminalia myriocarpa*, *Artocarpus Chap-lasha* and *Bombax malabaricum*. Some of these species are raised in nurseries and put out as seedlings. The initiation of the work at Sukna in the Kurseong Division was difficult owing to the area being notoriously unhealthy and *taungya* cutters were unavailable. A small labour force of about fifteen to twenty houses has been established, and the field crops, chiefly jute, which belong to the Department, are raised and the sâl seed sown with this labour. The sale of the field crops goes to pay the labour staff. The growth of the sâl (sown in lines) is exceptionally good (the lines run right across the plantation, are 6 feet apart, two to three seeds being sown in each line at 4 inches by 4 inches apart). The growth of some of the other species being tried is even more rapid. Weeds are bad and clearing has to be undertaken for two to three years. At first the experiments made with other species were carried out in a rather haphazard fashion, but a more regular method of utilizing the ground is now being introduced. It must be remembered that in this region of Bengal there is a demand for fuel by the tea gardens, so it should be possible to dispose of all species grown. Up the hill at Toong (6000-7000 feet) *taungya* is also being practised, the chief species planted here being *utis*



1923 SÂL PLANTATION AT SUKNA.
W. E. Hodge, photo.





GHAMARI PLANTED IN MOHURGONG IN 1923.

W. L. Hodge, photo.



(*Alnus nepalensis*), *pipli* (*Bucklandia populnea*), walnut and *Cryptomeria japonica*.

The same class of work is proceeding in the Jalpaiguri and Buxa Divisions. The weeds are even heavier here. In the latter the method came into force in 1920, after the expiry of the old Working Plan. Sâl was at first sown in lines 12 feet apart, subsequently reduced to 9 feet and 6 feet apart, as at Sukna.

Other species used are *champ* (*Michelia*), *malagiri*, *lampatia* (*Duabanga*), *tun* (*Cedrela Toona*), *simul*, *sissu*, etc. Costs work out to Rs.18.8 for the first year and Rs.39.8 to end of the fourth year when plants are established. At the end of 1924-5 the area under *taungya* plantations was 1708 acres.

In the Darjeeling Division in the past the Selection, Coppice with Standards and Group Systems were all tried. None were successful, and Clear Felling and artificial regeneration is now applied. As far as possible *taungya* cultivators are encouraged, though some areas are unsuitable to field crops. *Taungya* regeneration reduces the costs of formation by 50 per cent. The Takdah Plantations (elevation 5200 to 6500 feet) are a good example. The annual coupe is 31.3 acres and *Cryptomeria japonica* (on a forty-years' rotation) is used. The cultivators grow Indian corn on the cleared areas, after burning the rubbish, and stake and plant the area, 6 feet by 6 feet, with one-year-old nursery plants supplied by the Department during the first year, and tend them free of charge throughout the second year. A little grass comes in the third year. This method has been in force since 1919. The total cost per acre is 10 annas for carriage of plants and Rs.2.8 for nursery costs. It is hoped to grow 6-foot girth trees in forty years.

It would be difficult to speak too highly of the remarkable work thus being carried out in Bengal, work which it is now hoped to extend on a considerable scale in the Chittagong Divisions in the south-east. The author had the good fortune to see some of it with Shebbeare, the Conservator, both in the Darjeeling, Kurseong and Buxa Divisions.

3. *Taungya Plantation Work in Assam*.—Conflicting opinions appear to be held as to whether the best results will be obtained from *taungya* work in grass areas which are devoid of sâl or from areas from which the forest has been clear-felled and then artificially regenerated. The Bengal opinion, held at least by some, is that the latter will unquestionably yield the best result,

whilst in Assam, amongst certain officers, it inclines, it is believed, to the former.

The Goalpara Forests are conterminous with, and of a similar character to, those of the neighbouring Buxa Division. No *taungya* work had yet been commenced in Goalpara, the Division having been more concerned with the exploitation of the fine sâl to be found there. During my visit to Goalpara in February (1925) Meiklejohn marked out an area in which he hoped to regenerate in this fashion during this season (1925).

In the Cachar Division artificial reproduction had been under consideration for some years. The type of forest is mixed evergreen and bamboo, yielding on an average one mature tree per acre. These forests are extensive and have produced a good revenue in the past. The method of collection has been dealt with already (II, p. 398, and p. 229 *supra*). As Mr. C. J. Rowbotham correctly wrote (*Indian Forester*, 1924), the revenue was collected "without much more outlay of expenditure other than that involved in the upkeep of revenue stations on river banks. Continual skinning of the forest within easy elephant dragging distance of the banks of rivers, without any silvicultural improvement of the growing stock, brought the Forest Department to realize that the previous state of affairs could not continue indefinitely, and that the ever-decreasing revenue must in course of time diminish to such an extent that it would no longer pay to maintain a large staff of Forest Officers, working only in revenue stations, merely to tax the timber trade." The same remarks applied equally to the management of the forests in the Chittagong Hill Tracts, which were "worked" in the same fashion. In 1921 the Conservator of Forests gave orders to commence planting out teak under the *taungya* method in the Cachar Division. The difficulties met with were the lack of knowledge, the disinclination of subordinates, accustomed only to revenue station work, to undertake their new job, the suspicion of the *jhumers* (the hill people practising shifting cultivation) and the absence of communications through the forests. These troubles were overcome, the land hunger caused by the ever-increasing population of the district inducing some of the local Cacharies, Kukies, Lushais and Tipperahs to accept the terms of the Department. An experimental area of 5 acres was planted in 1920. After cutting and burning the jungle the area was planted with (1) root and shoot cuttings, (2) planting entire with balls of earth, and (3) without balls of earth. The

first method gave a very much more rapid growth and proved to be the best way to get the teak above the *Eupatorium* weed. In the following year further areas were undertaken with teak seedlings planted in May, 30 feet by 8 feet, placing four seedlings 2 feet square in a square at each stake, the low-lying land being planted up with *jarul* (*Lagerstrœmia Flos-reginæ*) after the men had reaped their new crop early in the cold weather. The placing of four seedlings at each stake was said to have given excellent results, as it prevented the young teak being overcrowded by the paddy (rice). In the following year surplus teak plants at stake in the original lines were utilized, after being root and shoot pruned, to plant up intermediate lines 10 feet apart. In places *Macaranga* seeds were sown between the lines of teak in the second year, and this is likely to prove useful in keeping down the *Eupatorium*. The average height of the teak after two years was 6 feet wherever it had been properly weeded during the rains. In some cases the height growth reached to 18 feet. In 1923-4 some 29 acres were undertaken, and in 1924-5 about 26 acres of new *taungyas* were cut and burnt. The average height of the teak in a three-year-old plantation (planted 1922) was 20 feet to 30 feet in March, 1925. One or two interesting points are worth comment. Rowbothan wrote (March, 1925): "Large teak plants (5 feet to 12 feet high) were brought from the neighbouring district, Sylhet, in February, 1924. After being root and shoot pruned they were planted out here at the end of last rains and have shot up 12 feet to 15 feet." He also added: "Attempts are always made to introduce some quick-growing species like Jack fruit (*Artocarpus Macaranga*), or Kadam (*Anthocephalus*) in between the teak lines after it is established 10 feet by 8 feet apart, and the *jhumers* have abandoned the area, to prevent dichotomy of the teak later on and also with the idea of forming an under forest beneath the teak. I noticed, when visiting the fifty-year-old teak plantations at Kulsi in Kamrup, that any heavy thinning of the teak had been followed by an outbreak of epicormic branches on the remaining trees, which perhaps an under forest of other species might have prevented." This matter is considered in greater detail later on.

Taungya regeneration was commenced in the Sylhet Division in 1922, and progress has been made in the experimental work. Teak is the chief species, and, owing to the heavy wood growth, root and shoot cuttings are now made use of which produce a 6-foot plant in a year. Other species

are utilized, such as *Gmelina arborea* and *Artocarpus Chaplasha*, etc., for filling in between the lines of teak, since they do not require so much attention. The people employed are the Tipperas, who are accustomed to *jhuming*. An interesting experiment commenced in 1924 is to lease out scrub areas for twenty years for the growth of *jack* (*Artocarpus integrifolia*) and *Eriodendron anfractuosum* with pine-apples. A rent of 4 annas per *bigha* is charged, and in twenty years the afforested area will revert to the Department.

Taungya Plantation Work in Bihar and Orissa.—Experiments with teak *taungya* have been tried in Augul and Puri during the last year or two (1925) with some success. It is hoped to expand the work and make use of other species such as *Dalbergia latifolia*, *Pterocarpus*, etc.

4. *Taungya Plantation Work in the Central Provinces.*—The following note appears in the Annual Forest Report for 1923-4 : "The Bhoomias of the Lormi Ranges of Bilaspur have been induced to sow teak and tend it in the second year of cultivation. A total of 568 acres was cleared in 1922 and sown with teak, sâl and *bija* (*Pterocarpus marsupium*) during the early part of the rains of 1923." The seed and tending were not beyond criticism; the expenditure on collection of seed, sowing and weeding was Rs.76.4. "In Berar 1500 acres were leased out on the agri-sylvicultural operations, and 974 acres abandoned on the termination of leases, leaving a balance of 9175 acres at the close of the year; 260 acres in twenty-one plots were given out to good cultivators on a seven-years' lease in Yeotmal for raising *Terminalia tomentosa*, *Anogeissus latifolia* and teak along with field crops. The annual rent varies from Rs.1 to Rs.6 per acre. . . . The raising of sâl and teak by *taungya* should be encouraged and extended wherever possible. A forest population educated to *taungya* work may be most useful when the new Working Plans are made." On what are known as the *babul* (*Acacia arabica*) *bans* (woods) in Berar, running from 1-50 acres, the procedure is the same. These were originally waste lands with a *babul* crop on them. The Government leases the land for seven years, the lessee buying the crop of timber on it. He grows cotton on the land as long as it is profitable, sowing *babul* seed in the second year and tending it from the period of lease. The land is so profitable that it pays the cultivator. If the *babul* crop is valuable Government cuts and sells it before leasing the land. The *babul* rotation is thirty years.

A small experiment with the *taungya* method has been commenced in the Seoni Division, but it is too early to give any details of the results.

5. *Taungya Work in Coorg*.—This method has replaced the teak plantation of last century. The work was commenced in 1890, the Kurubars undertaking to sow teak seed in their *kumris* of *ragi* and hill paddy (rice). The sowing is done in the hot weather. The area is again burnt and cultivated during a second year and casualties amongst the teak are replaced. At the end of the second year the men are paid Rs.1.4 per 100 surviving plants. This method has been remarkably successful both for teak, rose-wood and *Pterocarpus marsupium*. In the Ghât Forests the attempt to raise teak was given up in 1912, sowings of valuable evergreen species being made in *kumris* (*taungyas*).

6. *Taungya Plantation Work in the United Provinces*.—Quite recently *taungya* work has been introduced into the Gorakhpur Division, which has achieved almost a world-wide notoriety owing to the high net returns per acre obtainable from the comparatively small area of the Division (175 square miles). This enviable result is due to the great demand by the large neighbouring population for produce of all kinds from the area, even down to brushwood, weedy undergrowth and leaves.

The Gorakhpur Division may be roughly divided into three parts: the southern area comprising several small detached blocks of forest, which are worked under the Coppice System on a forty-year rotation; a central area, worked on a rotation of fifty years; and the northern area, to be worked on a rotation of 100 years. The coppice areas will be described later. Under the 1925 Working Plan a modified system of Clear Felling is prescribed for all the *sâl* forests of the Division, a step which has been made possible by the great improvement in technique of *sâl* regeneration gradually evolved by the Divisional Officers during the preceding ten years. The reason for the introduction of *taungya* regeneration was due to the fact that the 1920 extension of Clear Fellings to areas in which suppressed coppice or advance growth was absent resulted in the failure to regenerate extensive areas. Mr. Wood solved this problem by the introduction of *taungya* on a large scale. This solution has solved the regeneration of areas which cannot be re-clothed with a coppice crop. Details of this work are given in the *Indian Forester* (March, 1925) and in *Practical Forest Management in the United Provinces*, by Trevor and

Smythies. Briefly, the *taungya* work consists in giving the land for cultivation for five years, the sâl seed being sown in lines in the first rains, and kept thoroughly weeded and tended by the cultivators, free of cost. At the end of five years the sâl should be 6 feet high. The lines were at first 18 feet apart, but the distance is now being decreased; the intervals are filled up with quick-growing species, such as teak cuttings. *Terminalia tomentosa* is being used, a one-year crop seen being 5 feet in height at West Lehra, where successful work is in progress. The *taungya* work has proved popular with the cultivators, who obtain good crops from the forest soil. The *taungya* method has spread to the adjoining Gonda Division.

7. *Taungya Work in the Punjab*.—The only attempts made so far to regenerate areas by the *taungya* method have been in the Himalayan Divisions. On the subject the Chief Conservator writes as follows (*Pro. Rep. For. Administr., Punjab, 1923-4, p. 21*): “*Taungya* Plantations.—Departmental operations to re-establish deodar in the Kiuli experimental plot in the Lower Bashahr Division have now been completed. As a demonstration to the villagers it was a success, as it has shown that good catch crops can be raised on forest land that is being restocked. As a financial project it was a failure and convincing proof that the Department is not equipped to grow food crops at a profit. The Nagni area in Kulu was cultivated by local zemindars under this system and, after the crop had been harvested, seed was sown along with the second crop; germination was satisfactory. The scheme in Seraj is reported to have failed owing to the unwillingness of the zemindars to co-operate: there are too few people to take up additional land for cultivation.” This latter remark alluded to the higher hills in the Himalaya where the population is very sparse.

II. CLEAR FELLING WITH SOWING, PLANTING OR NATURAL REGENERATION

For various reasons, the absence of *taungya* cutters in the area, the difficulty of obtaining other suitable labour, the size of the areas and so forth, clear felling is not always followed by the *taungya* method of regeneration. The processes of sowing or planting, or a combination of both, are resorted to, and most interesting modifications, devised to meet local conditions, are now in practice. Natural regeneration is in some places available.

1. *The System in Madras* —The best-known example of clear



COMPARTMENT 33 OF 1846 PLANTATION PLANTED IN CONNOLLY'S TIME,
NILAMBUR TEAK PLANTATIONS. KEPT UNFELLED FOR OBSERVATION PUR-
POSES. PHOTO. BY A. F. MINCHIN DURING AUTHOR'S VISIT, MARCH 1925.
MADRAS PRESIDENCY



A SECOND ROTATION TEAK CROP, NILAMBUR PLANTATIONS. ARAVALAKAD
1918 PLANTATION. PLANTED BY MR. RAY BOURNE, I.F.S., WHO CUT THE
FIRST OF THE OLD CROPS TO BE FELLED. PHOTO. BY A. F. MINCHIN, I.F.S.
MARCH 1925. MADRAS PRESIDENCY

felling and planting, as it is the earliest, is to be found in the Nilambur teak plantations. These have been alluded to in several preceding parts of this history, and it will be remembered that the procedure commences by the felling of areas of deciduous forest, the subsequent burning of the unused refuse, followed by the planting of teak seedlings. The plantation is still being extended. The difficulty is to sell the fine material other than teak (chiefly splendid *Terminalia paniculata*) cut out. The oldest compartment of this plantation reached the felling age in 1916-17 and to Mr. Bourne, the Divisional Officer at the time, fell the honour of marketing the first crop which the genius and enthusiasm of the Collector, Conolly, had originated so many years ago.

In 1917-18 the total area of plantations=6591 acres, of which 4764.8 acres were successful, 1319.4 acres were a failure, and 506.8 acres permanently blank. The total volume of growing stock : stem wood quarter girth, in 1917-18 amounted to 5,148,486 cubic feet.

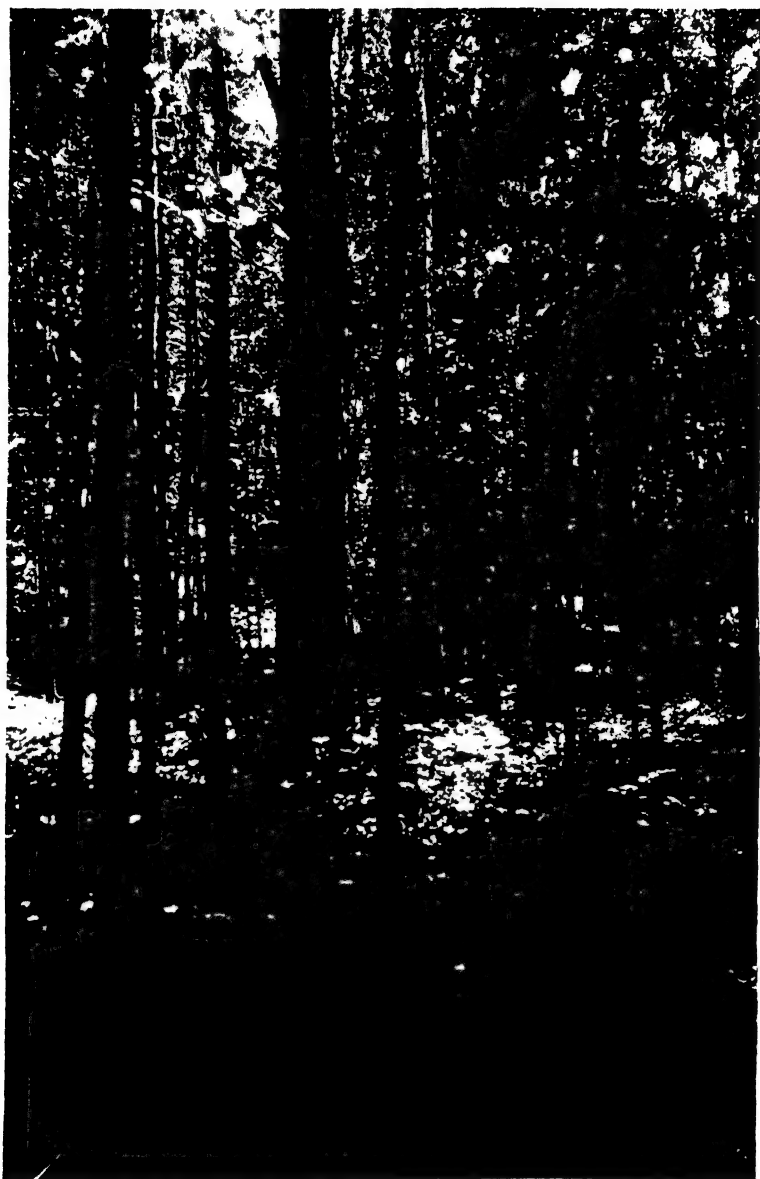
The following gives the fellings, etc., of the old crops between 1916-17 and 1918-19 :

Year of felling.	Age in years.	Area.	Quarter girth volume stem wood.	Net value per c. ft. ranging between.
1916-17	72	22.3 acres.	40,747 cub. ft.	—
1917-18	part 75. part 64.	46.8 acres.	70,877 „	Rs.1.493 and Rs.5.049.
1918-19	72-73.	65.5 acres.	139,387 „	—

The first crop of the second rotation is now eight years of age, with intermediate ages. The Moplah Rebellion (1921-2) interfered with planting work and thinnings, and the floods of 1924-5 swept away 170 acres of young plantations. An examination of the young second-rotation crops scarcely shows the promise of those of the first rotation. The growth is rather uneven and the height growth is inferior. The question, which it would appear demands an early answer, is : Will the second rotation of pure teak on this area produce the same yield or anything like the same yield as the first? It is

admitted now in some quarters that it was a mistake to remove all undergrowth in the plantations as was consistently done for years. An examination of the forest floor of the most recently felled old crop would certainly appear to bear out this contention. It is dry and hard with little humus present. Allowing the area to lie fallow for a year has been without result. A further point which arises in the general management of teak is that the species is leafless during the hot season, the soil being consequently exposed. Another difficulty which has made its appearance is that, owing to the almost complete utilization of the material from the old crop, little remains for the necessary burning before the young teak seedlings are planted out. And yet a thorough burning of the area is recognized as essential to the subsequent good development of the young teak. Experiments have been commenced with the object of producing a mixed crop with *Hopea* and *Artocarpus hirsuta*. Tireman, the Chief Conservator, recommends the use of *Hopea parviflora*, having observed that this species does well with teak. There is an excellent example of this on a small scale at Edacode (Comp. 82), which I had the pleasure of seeing with the Divisional Officer in March, 1925. I recorded the following note at the time: "*Hopea* with teak is like being in an oak and beech forest. In every case here the epicormic branches of the teak, some of considerable size, are to be seen already dead. The *Hopea* branches are horizontal, like beech, and impinge on the teak stems and clean them of all side branches, and prevent the teak throwing out epicormic branches, to which it is addicted; and more especially in these pure plantations if at all open. The *Hopea* in this area came in about twenty years ago, the teak being now about seventy years old. The *Hopea* has an evergreen habit with a dense foliage of small dark green shiny leaves. The stems of young trees have whitish blotches on them and are not unlike young beech. The illusion to an oak and beech forest in France is remarkable."

Another point which requires settlement is the question of adequate burning. In Bombay, where the same trouble is being experienced, to be discussed shortly, they collect all available brushwood left and lay it out in patches over the area and burn these, thus assuring a good burning on the patch. These patches are then sown or planted with teak, the intervening areas (if not capable of producing a coppice crop) being sown or planted with other species. It appears to be decided

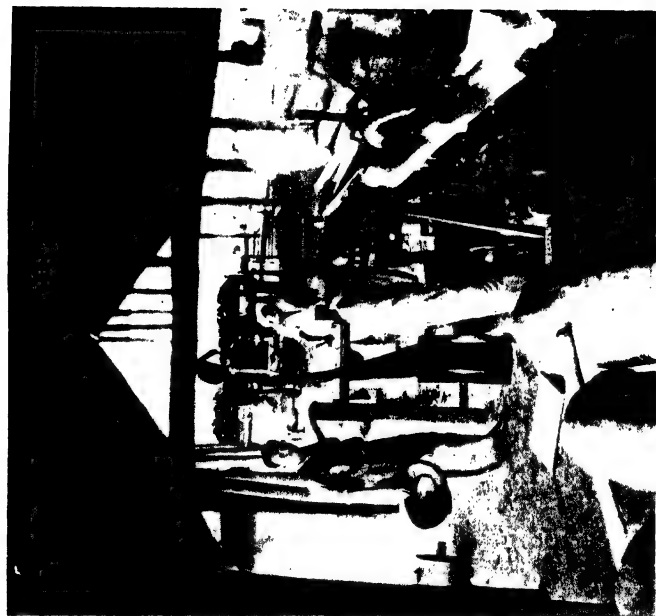


ARTOCARPUS HIRSDTA SUCCESSFULLY INTRODUCED AS AN UNDERWOOD IN A TEAK PLANTATION. *ARTOCARPUS*, 18 YEARS. TEAK, 57 YEARS. THE TEAK IS BEING CLEANED OF EPICORMIC BRANCHES. MADRAS PRESIDENCY

J. M. Sweet, photo.



NATURAL REGENERATION OF MALINDI BY ROADSIDE IN
PANNESCODE BLOCK, NILAMBUR. THE TREE IS A SHADE
BEARER AND MAY, AS IN CASE OF *Hopei*, BE USED AS AN
UNDER-STORY FOR TEAK. PHOTO. BY A. F. MINCHIN, DURING
AUTHOR'S VISIT MARCH, 1925. MAURAS PRESIDENCY



AMERICAN PORTABLE SAWMILL ERECTED AT THE BEYTUR
RIVER DEPOT FOR PREFABRICATION OF SLEEPERS, ETC. MADRAS
PRESIDENCY, 1925
A. F. Minchin, photo.



SILAMBU'R TEAK PLANTATIONS. COMPL. 15 Felled, cleared and ready for planting (in June, 1925) the second rotation crop of teak. In foreground coolies are preparing a nursery for raising teak plants. March, 1925. MADRAS PRESIDENCY





TEAK REGENERATION IN THE HATHAL TEAK POLE AREA, KANARA, N.D.
(KHAMDALI VII 2.) 5 MONTHS OLD. PHOTO. BY A. C. HILEY, 14 XI. 1925



A 1920 TEAK PLANTATION IN COMPT. 9, MINHIA RESERVE,
THAKRAWADDY DIVISION. TEAK WAS SOWN 6FT X 6FT.

that pure teak in a second rotation is too grave a risk (and would any Forest Officer be prepared to put money of his own into the undertaking?). Perhaps this method might be tried, the intervening spaces being sown or planted with other species. An underwood of bamboo is also suggested. In any event the point which requires early solution by the Sylviculturist, as also by the Mycologist and Entomologist, is the fundamental one as to whether the cultivation of pure teak, or pure sâl and certain other species for that matter (the worship of the single species, in other words) is sound sylviculture in the Forests of India! At Nilambur small experimental areas have been sown up with *Lagerstrœmia Flos-Reginæ* and *Terminalia tomentosa*. In the extensions these two species and rosewood have been interspersed in small patches with the teak. *Bombax malabaricum* is also being used.

Clear felling is also practised in the Mount Stuart Forests, the areas being sown up chiefly with teak; where the soil is too waterlogged they are sown up with *Terminalia tomentosa*. These operations were started on a small scale in 1919. By 1923-4 some 863 acres had been stocked with an established crop, in parts of which *Adina cordifolia* has come in naturally as an understory. In the Upper Godaverî, after clear felling, the debris is stacked in heaps and burnt, and these areas sown up with teak. The Gumsur Sâl Forests (Ganjam) Working Plan prescribes clear felling and cutting back of the young growth and burning, a good young crop being thereby obtained.

2. *The System in Bombay*.—Some three years ago a commencement was made in the North Kanara Division with clear felling and artificial regeneration. Under the new Working Plan now being completed by Mr. Davis areas have been selected in each of the two Working Circles, which are to be worked under this method. The total area selected (the areas are not contiguous) is sufficient to last for twenty years, which is the period which will elapse between the Improvement Fellings made in any block, the rest of the forest being worked under the Selection System. Practically speaking, these areas therefore form Periodic Block I of the total area to be worked under concentrated regeneration by the *Quartier Bleu* method. The Working Plans Officer is unable to indicate even roughly the areas which would fall into Periodic Block II, owing to the fact that the bamboo may flower and seed some time during the twenty years and

this will influence the selection of areas for the latter Periodic Block.

A one-year-old plantation was seen (in March, 1925) in company with the Divisional Officer, a contiguous area having been already cleared and burnt in readiness for planting this season. The method is to plant alternate lines with one-year-old teak seedlings, grown in a dry nursery, the intermediate lines having teak seed dibbled in, the distance in each case being 6 feet. The growth in the one-year plantation was remarkably good, due it was said to the long and heavy rains of 1924. A good burning of the refuse on the area is regarded here as essential to the future success of the young plants, and the fiercer the fire the greater the assurance of success. This is a most interesting departure in the Division and, with the experience which a few more years should give, promises to be very successful. In this instance, again, it was suggested that the teak would probably give better results if it were either grown in mixture or interplanted within the first few years, and the Divisional Officer is going to experiment in this direction. For such work a Sylviculturist is badly needed in Bombay.

Another plantation of a slightly different nature is the Nagargali plantation in the Belgaum Division. It is one year old and the results are so far successful. It has been mentioned above that a good burning is essential before sowing or planting teak on a cleared area. Here, owing to the demand for material for the coupe, insufficient material is left on the area to ensure a fierce fire. The procedure is therefore to collect the tops and refuse and spread them over patches of varying size and then burn the mass. Only the patches which have been so burnt over are then planted up with one-year-old teak seedlings. The intervening spaces become filled up with other species, teak, blackwood and other coppice shoots, and a full crop appears to be assured. At present only teak are planted out on the patches, any number up to 200 or so, depending on the size of the patch, the planting distance being 6 feet. It appears possible that it would be advisable to put out a mixture on the larger patches, using *Xylia* which is in leaf when the teak is leafless or the valuable blackwood and so forth. Of course, under the method the resultant crop will be a mixture in any event, and this is certainly in its favour. One of the troubles noted in this plantation was bison, a herd of which had gone through it the preceding night. These animals browse down the blackwood



NATURAL REGENERATION OF SÁL.—ANNUALLY CUT BACK BY
FROST—BALAGNAT, C.F.

D. O. Hitt, photo.

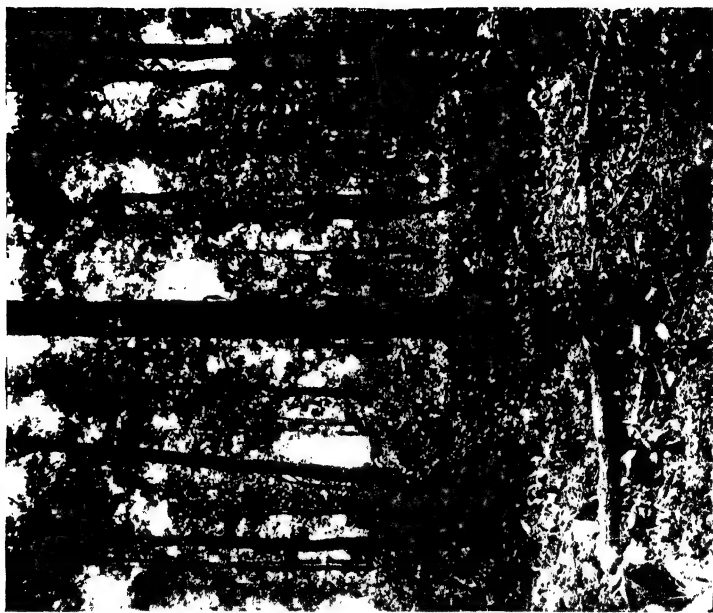


(PLAYS LONG/PRUL) PLANTATION, 17 YEARS OLD, SOWN BROADCAST
UNWEEDED. NOTE FROSTED SÁL. SUPKHAR, BALAGHAT DIVISION,
2,500 FT., CENTRAL PROVINCES

D. O. Hitt, photo.



CHIR PINE (*PINUS LONGIFOLIA*) PLANTATION. SAMPLE PLOT,
IN 1960. THINNING AND HEIGHT 25.5 FEET. STUDY AD



NATURAL REPRODUCTION OF SAL ON HOETI STRIPS AT
SEOWARI, COMPT. 1310, SINGBHUM FORESTS. PHOTO. 26

coppice shoots of which they are particularly fond and bite off the leaders of the teak seedlings, thus giving rise to forked trees. These latter are cut back in order to get up a strong coppice shoot. It was noted that the teak coppice shoots from the stools were already above the reach of these animals. But the damage a herd can commit in a single night has to be seen to be credited.

In all Circles clear felling in high forest is undertaken, followed by sowing and planting of teak. In addition to North Kanara, Belgaum, the Dangs and Peint may be instanced. Nurseries are maintained to provide the plants. At times the latter supplement natural regeneration, teak and *mohwa* (*Bassia latifolia*) being raised artificially.

3. *The System in the Central Provinces.*—A very interesting experiment, which perhaps finds its place here, is the use which is being made of the *chir* pine (*Pinus longifolia*) in the Central Provinces. It has a parallel in the great oak and beech forest of Tronçais in the Department of Allier in France where the Scots Pine is grown for very much the same purpose, i.e. to clothe and clean frosty areas covered with the *Agrostis* grass and make them suitable for the introduction of oak in the next rotation. The *chir* pine is being introduced in the Raigarh Plateau of Balaghat, where the failure of the *sâl* to reclothe the large and extending areas of blanks is largely due to frost. At Supkhar it was observed that what appeared to be promising regeneration was yearly cut back by frost and never reached the pole stage. A plantation of *chir* pine was commenced here, and has proved successful; the following tabular statement (*Ann. Rep. For. Res. Inst.*, 1923-4, p. 27) shows that the growth compares favourably with that of this tree in other Provinces :

Age in Years.	Aver. girth in inches.	Max. girth in inches.	Aver. ht. in ft.	Max. ht. in ft.	Stems per acre.
5	—	—	2.5	5.0	6000
10	5.8	14.5	11.0	18.4	3600
15	10.0	28.5	23.4	33.4	1880
20	12.5	30.0	35.6	47.0	1510

Volumes per acre figures for small wood from sample plots laid out are : Age 13=1917 cubic feet. Age 17=2075 cubic feet.

This experiment is well worthy the careful study of Forest Officers. Too much time and too much money have been wasted in the past in endeavouring to get up valuable species in derelict areas subject to frost or drought, or covered with heavy weed growth. Nowhere perhaps is a better illustration afforded of these conditions and the way they have been dealt with during the past seventy years or so than at Tronçais. Many other lessons of high utility to the Forest Officer, whose work lies in the teak and sâl areas of India and Burma, are to be assimilated in this great forest.

4. *The System in Bengal*.—In the Darjeeling Division clear felling and artificial regeneration was introduced in 1921. In areas which are unsuitable to the growth of field crops planting on payment has to be resorted to after the clear felling.

5. *The System in Assam*.—Sowing in lines after clear felling has been started in the Poba Reserve of the Sadiya Division. The unmarketable trees are removed by the Assam Sawmills and Timber Company. The trees which are left are of small girth and climbers are plentiful. Naga coolies are employed to convert this material into fuel, which is sold to the Sawmills at about Rs.14 an acre. The refuse is burnt, and seed of *Terminalia myriocarpa*, *Morus laevigata*, *Cedrela toona*, *Lagerstræmia Flos-Reginæ*, *Chikrassia tabularis* and *Bischofia javanica* is sown broadcast in lines 20 feet apart. *Terminalia* seed is abundant and is used as a nurse for the other species. The sowing is done to prevent weed growth. The lines are first cleared of any rubbish and lightly hoed. The intervals become filled with a certain amount of coppice and tall upright grass 15 feet to 20 feet high which assists in drawing up the plants. The seeds are mixed in the proportion of *Terminalia*, 12; *Tun*, 2; *Lagerstræmia*, 1; and *Chikrassia*, 1, part. This method has proved successful, and now (1925) the whole 80-acre coupe is sown up. The cost of formation is covered by the sale of the fuel, when this is saleable. Sowings at stake do not give as good results as broadcast, and require cleaning during the rains. As regards growth, a plot of pure *Terminalia* sown in 1921-2 is now (three growing seasons) = 20 feet; 1922-3, *Terminalia*, *Morus* and *Tun* (two growing seasons) = 9 feet to 14 feet; 1923-4, the same (one growing season) = 3 feet to 4½ feet; *Terminalia*, broad cast (one growing season) = 4 feet to 5 feet.

6. *The System in Bihar and Orissa*.—In three of the Chota Nagpur (Singbhum) Divisions, Saranda, Kolhan and Porahat, the regeneration of sâl presents no difficulty over considerable

tracts. The system now applied, which is termed the Uniform or Shelter Wood Compartment System, is in reality a modified Clear Felling. For this reason it is included here. The old sâl crop was cut out, leaving a certain number of poles scattered over the area. The modern procedure in some parts is to take out these poles as well and then to burn the area in early April. The fire burns down all the young regeneration, which is prolific, to the ground, but does not kill the roots of the sâl, which sends up a strong shoot from beneath the surface of the soil. Nicholson, the Research Officer of the Province, who showed me an area of this type, says that under this treatment an even and dense crop of shoots is obtained, which are both seedling and coppice, all over the compartment.

In the High Forest Working Circle, in the Sambalpur Division, clear felling has been adopted since, for various reasons the Uniform System would be more difficult to work. Regeneration of sâl is good to fair. In one series modified Strip Fellings have been introduced for protective and regeneration purposes. The strips are from 1 to 5 chains broad with five-year intervals between fellings. The narrower the strip the greater the protection afforded the young crop, but for convenience in working the strip is widened where possible. These narrow Strip Fellings in numerous cutting series were adopted, as the annual coupe averages nearly 500 acres, and since the crop consists chiefly of sâl it would be dangerous to clear fell so large an area in one spot.

7. *The System in the Punjab*.—The following note (*A.R. For. Res. Inst.*, 1923-4, p. 38) dealing with this Province is of interest as showing the wide variety of problems the Indian Forest Officer has to deal with. In the course of regeneration operations in the *Populus euphratica* forests of the South-West Punjab (which partake of the nature of clear felling and regeneration by root suckers) it was found that while regeneration was entirely satisfactory in areas which contained numerous stumps of felled trees, it was more difficult to obtain in areas less well stocked with stumps, often indicating stiff or saline soils. In the latter areas considerable improvement in the stock of root suckers was obtained by ploughing with an ordinary country plough, or hoeing up the soil.

8. *Plantations*.—Plantations of Casuarina, teak, sâl and other species are in existence in every Province. These mostly come under the Clear Felling System and have already been alluded to in previous parts of this history (II, 563-573).

Sandalwood plantations are being made in Cong, 50 acres being sown annually with successful results.

The Kulsi teak plantation (Assam) of 143 acres, commenced in 1872, was stopped in 1882, owing to the heavy cost. Thinnings by girdling, since the material is unsaleable, were started in 1917. To 1925 some 2077 trees have been girdled, giving an average per tree of 26 cubic feet. The growth is rapid, 1782 trees average 102 feet 6 inches in height and 5 feet 10 inches in girth, and the timber is said to be good. The plantation suffered from want of early thinning.

III. THE COPPICE WITH STANDARDS SYSTEM

Although this system is still in use in most parts of India, especially in plantations such as Changa Manga, modern practice has condemned its application on the large scale to replace the Selection System. During the early periods of the present century the system had been introduced over wide areas in the Bombay Teak Forests, and in those of the Central Provinces, whilst to considerable areas of forest in the United Provinces, such as Gorakhpur, Pilibhit, Dehra Dun and so forth, this management was prescribed. A decade to a decade and a half was sufficient to demonstrate that this form of management applied to large areas of forest was faulty, whilst in areas where the coppice was of high value, e.g. Thana, Gorakhpur, etc., the maintenance of a considerable number of standards resulted in retardation of and a loss of increment in the valuable coppice. For instance, in Gorakhpur between 1893 and 1913 the fellings in the standards were too light and the coppice was suppressed. The present management therefore prescribes either the removal of all standards and the growth of a coppice pole forest on a varying rotation based on the demands of the markets; or the growth of a high forest either on what may be termed improved methods under the Selection System; or under one or other of the systems being described. It is unnecessary here to do more than allude to this change in opinion and management; its development will be discernible in the review attempted in this chapter. The Coppice with Standards and Coppice areas in the Punjab will be dealt with in a subsequent chapter.

IV. THE COPPICE SYSTEM

Perhaps no more striking illustration of the adaptation of European Forestry methods to Indian conditions has been



ARTIFICIAL REGENERATION OF SÁL IN CLEAR FELLED AREA, 1922. RAMGARH FOREST, GORAKHPUR DIVISION
E. A. Smythies, photo.



YOUNG EVEN-AGED XYL CROP, AGED 37 YEARS, RECENTLY THINNED. RAMGARH FOREST, GORAKHPUR DIVISION.
E. A. Sinchias, photo.

witnessed in India than the gradual evolution of the coppice forest or coppice method of obtaining the new crop. In this section it will be necessary to confine the consideration to true coppice. But it may be mentioned that the regeneration obtained under other systems, notably the Uniform or Shelter Wood Compartment System in some Divisions, is in reality either wholly or in part coppice. A few of the most striking applications of the Coppice System will be alluded to.

1. *The System in the United Provinces.*—One of the most successful introductions of the Coppice System, both financial and silvicultural, into the management of a forest area is to be seen in the Gorakhpur Division. A brief review of this Division may be given. Prior to 1868 it had suffered from serious exploitation. Mr. Amery wrote in 1874: "The forests are all understocked and will need the most rigid conservancy for the next ten years." Nursing of the forests commenced in 1876, and between that year and 1892 only thinnings and improvement fellings were allowed. In 1893 a new Working Plan was made which prescribed Coppice with Standards. The coppice suffered as too few standards were cut, and the 1913 Plan prescribed clear felling with natural regeneration by coppice. This Plan broke down when areas were reached in which there was insufficient advance growth. As has been shown, Wood solved the difficulty by introducing *taungya*. The forest blocks in the southern parts of the Division are being converted from the coppice with Standards System to Coppice on a rotation of forty years. This conversion, whilst sound silviculturally, enables the large demand for poles to be supplied. All the middle areas of the forest, where a full crop of coppice shoots is obtainable under the conversion, will be managed on a rotation of fifty years. The oldest of the coppice areas under the conversion are ten years old and here the coppice shoots are not less than 30 feet to 35 feet high (1925) and had been recently thinned. All the material is saleable down to the brushwood, and incidentally the leaves, grass on the rides, and so forth. The growth in the younger age classes is equally good.

On the areas in the southern blocks, where old stools predominated after clear felling, teak was planted some years ago. An area of this kind clear felled in 1922 is now occupied (1925) by teak coppice shoots averaging 14 feet in height. There is a large demand, and in future it is proposed to underplant with teak a few years before clear felling takes place areas of sâl

where there will be an insufficiency of stools to give a full sâl coppice crop. The teak will be cut over with the sâl, and a teak coppice obtained. It is proposed to apply this treatment, it is understood, to areas to which *taungya* is inapplicable. Areas unsuitable to sâl or teak will be regenerated with root and shoot cuttings of *sissu*.

The following table exhibits the remarkable rise in revenue as a result of the fine management of this Division :

Period.	Average Annual figures of			Net amount surplus per sq. mile.	Remarks.
	Revenue.	Expenditure	Net surplus		
	Rs.	Rs.	Rs.	Rs.	
1893-1913	1,31,210	51,526	79,684	797	— Clear felling first introduced in 1914.
1914-1918	4,10,313	69,063	341,250	3,412	
1919-1923 and 1924	8,03,858	134,208	689,650	6,896	Clear felling extended in 1920.
Maximum figures in 1922-1923	11,21,681	1,17,533	10,04,148	10,041	

This shows an increase of from Rs.1.2 per acre for the first period to over Rs.15 per acre for 1922-3. The most intensively managed sâl forests (in south) actually pay over Rs.30 per acre per annum *net* revenue.

2. *The System in the Bombay Presidency.*—The Coppice System is being largely reverted to over certain areas in this Presidency in the management of teak. As has been already indicated in this history teak does not, and in all probability never has, grown to any great size over considerable portions of this region (I, pp. 111, 123). The teak is associated with *Terminalia tomentosa*, *Ougenia*, *Anogeissus*, *Adina*, *sissu* and *khair*, etc. The introduction of the Coppice with Standards method over extended areas, which received the approval of both Hill and (to some extent) Hart, Inspectors-General of Forests (*vide* Inspection Notes, July, 1901, and April, Dec., 1917) failed to give the anticipated results; and wherever the demand for poles was large it was at length recognized that the true silvicultural system was Coppice. A good illustration of this management



ADVANCE GROWTH RETAINED (AS THE CROP OF THE FUTURE) ON AN AREA OVER WHICH INTENSIVE REGENERATION FELLING HAS BEEN CARRIED OUT. NOTE THE GROUPS OF TEAK POLES ON THE RIGHT AND THE BLACK *RAB* PATCHES OF TEAK SOWINGS BETWEEN THE GROUPS. BOMBAY PRESIDENCY



TEAK REGENERATION IN THE HALIYAL TEAK POLE AREA.
THE TEAK SEED IS SOWN ON BURNT PATCHES IN MAY JUST
BEFORE THE MONSOON. CROP 1 YEAR OLD (KURIGUDDE II.
21). PHOTO. 20.11.25. ABOVE 2 YEAR OLD CROP (KURIGUDDE
II. 20). BOMBAY

is to be seen in the Thana Divisions (North, West and East) into which the old Thana Division has now been split up ; others are to be seen in the Dharwar and Bijapur pole forests, in the North Kanara coppice areas, Belgaum and so forth. In these cases the old method of management was Coppice with Standards. The change came about in 1917, when Clear Fellings were prescribed with a forty-year rotation, and an eighty-year one in the better blocks. As an example, the present method of procedure (which varies in Divisions) in the East Thana Division will be described. The coupes at Parali were visited in 1925 with the Divisional Officer. Some eight years ago it was decided that the future management here should be simple coppice, and at the present time coupes from that age to one-year old are to be seen. The demand for poles in Bombay, only fifty miles or so distant, and elsewhere is very great and consequently there is a high competition for the coupes, and the Divisional Officer is able to prescribe the conditions of sale in accordance with up-to-date methods of management. The prescriptions laid down are to clear fell the coupe. This is done by the purchaser, and under his contract he must trim close to the ground all the teak stools ; the contractor need not trim the stools of species other than teak. In practice he has found that the labourers make so many mistakes in leaving teak stools untrimmed if told to confine their work to them only, which mistakes, when discovered, necessitate the contractor sending his men through the coupe again, that the latter usually orders the men to trim all stools. The work carried out is excellent and can compare with the best to be seen in Europe. The effect of properly trimming a teak stool is remarkable. Fine straight coppice shoots are sent up from such stools, whereas the effect of cutting the stools high or bad trimming is to produce crooked, misshapen shoots. Much of the new practice in force in Thana is due to Mr. Majoribanks, the Conservator of the Circle. The difficulty already described at Nagargali in Belgaum is experienced here. The demand for materials is so great that the smaller branchwood is converted into charcoal in kilns made in the coupe. Nothing under 6 inches in circumference, of species other than teak, may be used for charcoal. But this leaves little enough for the burning which is required in those parts of the coupe, especially the upper portions of the hill slopes, in which teak seed is to be sown in order to complete the future crop, which mainly consists of coppice shoots ; it being understood that

the old growing stock of these forests is by no means a complete one. The branchwood is accordingly carefully spread out into '*rabs*' on the areas selected for artificial regeneration. The laying out of the branchwood has to be done by the contractor, who must have finished all work in, and quit the coupe by the end of April. The burning is done by May and the seed sown at the commencement of the rains. The spots on which the kilns have been burnt form excellent sowing areas, and the Divisional Officer naturally endeavours to get the kiln people to make their kilns on the poorer soil on the upper slopes where the stools are sparser, whereas the latter prefer to place them in the valley where the extraction of the charcoal is easier. In the burnt areas small circular patches about 1 foot diameter and 2 feet apart are thoroughly dug up, and in each six teak seeds are placed and lightly covered with soil. Weeding of the sown areas is an important business, the areas having to be cleared twice during the first rains and once during the second. The best results of the method are said to be obtained so far in North Thana. The first thinning is made in the fifth year, the teak being favoured, three coppice shoots as a maximum being left on each stool. In the fifteenth year a thinning is made to favour teak and cut out inferior species threatening the teak. Owing to the presence of Standards in some of the older coupes the thinnings are at times difficult to carry out. Thinnings in general will be commented upon later on.

In Sind fuel areas are worked as coppice. The method of combining agriculture with the raising of tree crops, known as Agri-cum-forestry, has been introduced in recent years. In the 1923-4 Forest Report it is stated: "The total area cultivated in 1923-4 was 5210 acres, Rs.32,833 being received by assessment. The method continues to give good results. Considerable areas were given out for cultivation as the method affords the best treatment for unstable *kachas* pending the time when the level will be raised to enable the establishment of a forest crop thereon." Pre-inundation sowings of *babul* broadcast, and in lines, patches and strips are undertaken elsewhere to supplement the coppice shoots. This has been discussed in previous volumes.

3. *The System in Bihar and Orissa.*—Some of the sâl areas in the Sambalpur Division are now worked with success as coppice.

The rotations are twenty, thirty, forty and fifty years

respectively. The short rotations supply the local demand. The object of the longer rotations is the conversion of the forest into an even-aged crop and to produce the largest possible timber under the Coppice System.

4. *The System in Madras*.—In the Clear Fellings in the Eucalyptus plantations near Ootacamund and Conoor the regeneration of the areas is by Coppice. These plantations have been already described in this history. In many cases they are in their fourth rotation and the yield is said to be diminishing. Steps are being taken to replant where the Coppice fails (II, pp. 567–8 and Plate).

V. THE UNIFORM OR SHELTER WOOD COMPARTMENT SYSTEM

It was long ere the Department broke away from the old Selection System in India and made tentative efforts to bring small areas under other systems. One of the reasons was due to the commonly held opinion that for the most part the regeneration of so large an area of forests could only be by natural means, and this contention, wherever feasible, remains true at the present day. But as has been already shown, modifications are possible, and this is equally true when conversion from Selection to the Shelter Wood Compartment System is in question. It was in the United Provinces that the first tentative experiments were made in the Himalayan coniferous forests, chiefly with deodar or mixed deodar and blue pine, and later *chir* pine. From these first beginnings the system, preceded in cases by the Group or Strip Systems, has resulted in a considerable extension.

1. *The System in the United Provinces*.—In the plains forests the bulk of the more important *sâl* areas were, previous to 1910, treated under the old Selection method. Some of the more accessible forests were under the Coppice with Standards System, whilst further areas of poor quality or partially ruined by bad treatment in the past were under simple "Improvement." Smythies, who was Provincial Sylviculturist for some years and has had much to do with experimental work undertaken, showed me the conditions in the Haldwani Division and gave me information upon which the following is based. In 1910 the Motipur Forests of the Bahraich Division were brought under the Uniform System, but the prescriptions of the Plan were unsatisfactory. In 1914 Collier included all the Bhabar and Terai Forests of the Haldwani Division in a "conversion to uniform" Working

Circle, with one felling series and six Periodic Blocks of twenty years each, subsequently amalgamated to three Periodic Blocks of forty years each. This Plan proved satisfactory, and with modifications, has been adopted for later Working Plans. In 1916 the Bhabar sâl forests of Ramnagar Division were brought under the Uniform System with a floating regeneration area and no definite Periodic Blocks. Difficulties arose in working this Plan and it was modified in 1921 on the lines of Collier's Plan. The advent of the Conservator of Working Plans Circle and the Sylviculturist enabled the new departure to be extended to other Divisions and the Working Plans to be revised, with the result that between 1921 and 1924 systems of concentrated regeneration in some form or other were introduced into the sâl forests of Dehra Dun, Ramnagar, Pilibhit, lower level sâl of North Kheri, S. Kheri and Gonda Divisions. Three distinct systems of regeneration have been evolved : (1) Gorakhpur *taungya* already described. (2) Some forests have an abundant advance growth such as the forests of Dehra Dun and many compartments of Ramnagar. The former may be taken as an example of the present practice. The system is the Uniform one, but the new crop is for the most part obtained from coppice shoots, as at Gorakhpur. In the Dun, however, frost is prevalent, and therefore a shelter wood must be maintained over the young crop till it has passed frost danger. Under the procedure in force what would usually be termed a seeding felling is in reality a first secondary felling made over young regeneration. After the material from the felling has been removed everything is cut back, especially all advance growth. Only good clumps of poles of fair size are left to form part of the new crop. Fire is then run over the area to burn all debris and clean it. This is done in March, or at least before the sâl coppice shoots begin to sprout about the middle of April. Immediate successful regeneration is thereby obtained and the young crop grows very rapidly. The sâl, unlike the teak, is not cut at ground level, nor is it trimmed—trimming produces poor coppice shoots. Species other than sâl are cut slightly higher than the latter ; consequently, on a newly cut-back and burnt area it is easy to ascertain the probable proportion of sâl in the new crop. Here, as at Haldwani, it would be inadvisable to aim at pure sâl crops for the future. There are one or two points still requiring further observation in connection with the method. It is cheap, the chief expense being the cutting of climbers which menace the

young crop in its earlier stages. Important points for settlement are the amount of density of the canopy to be left after making the first secondary felling, and how soon afterwards the rest of the crop is removable, and whether in one or more cuts. These are factors of the very first importance. There are successful small experiments of clear felling near Lachiwala, but the side protection afforded by the neighbouring high forest may be responsible for their success. The method is also employed in several Working Circles in Pilibhit and South Kheri.

Experiments are being carried out in the Ramnagar and Gonda Divisions under this method to obtain crops of *Terminalia*, *Anogeissus latifolia*, *Holoptelea integrifolia* and "haldu" (*Adina cordifolia*). Also with *Anogeissus pendula* in the Jhansi Division. (3) Extensive areas of sâl forest in the Province contain no advance growth. Here either frost danger or labour conditions, or both combined, render *taungya* regeneration impossible. These areas include most of the finest and mature forests in the Province, e.g. the Bhabar Forests of Haldwani and most of Ramnagar, the *damar* forests of Kheri and Bahraich, etc. Here natural regeneration from seed under a shelter wood with a floating regeneration block on the lines of the *Quartier Bleu* is in force. The Annual Forest Reports, local Working Plans, and Trevor and Smythies' *Forest Management in the U.P.* must be referred to for full details of the method. One example of the difficulties encountered may be given from the Haldwani Division, which I had the advantage of studying with Smythies in April, 1925. Three blocks of forest near Chorgallia (cf. II, Chap. IX), namely, Lakhmanmandi, Sunmanthapla and Sela, have been studied in detail since 1913. The first is of a distinctly moist type, with magnificent sâl growth and dense evergreen wood undergrowth. The second is intermediate and Sela is distinctly drier, with light grass and a moderate sâl crop only, often rather open. These are not virgin crops, but have grown up since protection started. In the days of the farmed contracts (put a stop to in 1858) every marketable tree was probably cut out, and thereafter the forests were hacked about and burnt by the people and grazed over. From the 1894 and 1914 Working Plans an analysis of the young growing stock, as it was then, can be compared with the state of regeneration at the present time (1925)—a period of thirty years. In 1913 there was a heavy crop of sâl seed and all the three blocks were regenerated with one-year seedlings, giving rise to Collier's conversion Plan,

By 1925 this young crop had practically disappeared in Lakhmanmandi, was considered to be fair in Sunmanthapla and excellent in Sela. It is noteworthy that the block where the regeneration has disappeared was kept densely stocked and had dense evergreen undergrowth, while the blocks which succeeded were of a drier type and either fairly heavily felled or fairly open at the start. Experimental work has been undertaken in Lakhmanmandi since 1919 by the Research Staff of the Province in collaboration with the Dehra Dun Sylviculturist. It is impossible to deal with the problem at great length. Briefly it appears certain that an abundant crop of seedlings can be calculated upon when required within from five to ten years. That success will be achieved if these seedlings can be nursed up to 3 feet in height. The problem remaining is how to nurse the crop up to this height without weeding in the rains, which has proved impracticable owing to the malarious state of the forests at this period. In the case where it was attempted nearly all the labour staff died. Frost and heavy weed growth (especially *Cleriodendron*) are the main troubles combined with the heavy shade of evergreen species such as *Mallotus philippinensis*, *loquat*, etc. A remark of Ribbentrops (*An. Rev. For. Adm. Ind.*, 1884-5, p. 21) with reference to Kheri Division is worth quoting: "The reproduction of sâl under *Terminalia tomentosa* is remarkable; this is due to the high canopy of the latter, and to the fact that the tree is out of leaf when the sâl seeds." Hole attempted to solve the shade difficulty by cutting strips. These are now covered with a dense and high weed growth. Fire is now being used in the compartments under regeneration to kill down the weed growth, one or two burnings between about December and April being undertaken. Regarding this problem from the aspect of the work carried out in the French oak and beech forests, the disappearance of the 1913 sâl seedlings from the Lakhmanmandi Block appears to be primarily caused by too heavy a shade. The same can be observed over a series of years in compartments in the French Regeneration Block which do not fail to have a seedling felling made within, say, five years after a heavy acorn crop. The dense mass of seedling oak gradually fades away and disappears. It may be suggested for areas like Lakhmanmandi that a preparatory felling made five years previous to the seeding felling, combined with annual burning of the weed growth during each of the succeeding five years might have useful results.



SAL SHELTER WOOD IN A REGENERATION AREA. 1023. LAKHMANMANDI BLOCK, HALDWANI DIVISION,
UNITED PROVINCES

Photo. taken by Mr. E. A. Smythies in 1023



NATURAL REGENERATION OF SAI UNDER A SHLIER WOOD, 1925. SUNMANTHAU BLOCK, HALDWANI
DIVISION, U.P. REGENERATION FROM 1913 SEED YEAR

Photo. by G. A. Sengupta, 1927

The employment of the Uniform System in the case of the deodar, blue pine and *Pinus longifolia* forests in the Western Himalaya is of considerable standing and will be dealt with in the Working Plan chapter. After the reservation of the Kumaun Forests they were placed under the system.

2. *The System in the Punjab.*—The first trained Conservator in the Punjab was Beadon Bryant, who took over in 1902. The beginnings of silviculture commenced from this year. The Working Plans of all the hill forests at this time were of the old Selection type, and officers in the Province, e.g. Lace, Hart, McIntire and Fisher, had realized that the system was unsuitable. In 1907 Fisher became Conservator, and the silvicultural revival dates from that time. The matter was discussed at the Forest Conference at Lahore in 1908, and after some controversy the Group method was adopted, and a Plan introducing this system was prepared for the Chamba State Forests in 1911. The system was proved unsatisfactory in a few years and the Uniform System was adopted, which is now the recognized system for the coniferous forests of the Province.

Experiments have also been undertaken in Kulu and Lower Bashahr with the object of ascertaining the best methods of regenerating spruce and fir, but so far the results have proved disappointing. The experiments were made in 100-foot strips and plots.

3. *The System in the Central Provinces.*—The Uniform System has been applied to the sâl forests of the South Raipur Division under the new Plan. Regeneration is plentiful in the better areas. Where necessary it is assisted by artificial sowings. Work has already commenced in Periodic Block I.

The working of the Saranda and Porahat, etc., forests in Bihar and Orissa (termed Uniform in the Working Plan) has been described under Clear Felling.

4. *The System in Madras.*—The method recently introduced of exploiting and regenerating the evergreen forests of the Chenat Nair in the Palghat Division in Madras is, in effect, a Shelter Wood Compartment System with natural and artificial regeneration. Each compartment or coupe is completely exploited of all marketable material and a shelter wood composed of the old hollow trees and useless species is left on the ground to protect the young evergreen crop. As has been said, this may be entirely natural or artificial combined with the seedlings and saplings already on the ground at the time of

exploiting the old crop. The experiments being undertaken to ensure the proportion required of the more valuable of the evergreen species, and the success already attained are of the highest interest and point unmistakably to the scientific intelligence and ability now being displayed by officers of the Department. Until recently the working of these evergreen forests (with a rainfall of about 120 inches per acre), and their regeneration had received little attention. In fact previous history furnishes evidence that their exploitation was considered to be commercially impossible. The area being, and to be, worked here consists of three valleys, each running up to the watershed, the Dhoni (nearly worked out), Sappal (working just started), and the Elaval. The lower part of the Sappal Valley was exploited to some extent about twenty years ago, but it is doubtful if figures exist as to how much was taken out. At the foot of the hill mahogany is being put in and is doing well. The work here divides itself into exploitation, under the Forest Engineer; and regeneration under the Divisional Officer, who has the co-operation of the Presidency Sylviculturist. There are many valuable and interesting sample plots maintained in this area (*vide A. R. of For. Res. Inst.*, 1923-4, pp. 48, 49). The regeneration work commenced about four years ago. It was at first considered that Clear Felling was necessary, followed by a burning. This was subsequently thought to be a mistake, and in any event there is no sale for hollow trees and inferior species. An area above Fisher's burn was treated in this fashion. A crop of mixed evergreen has come up which contains about 1000 good species to the acre, 5 feet average height, with inferior species making approximately a full crop. The present method is to leave standing after exploitation all hollow trees and species for which there is no sale; the crop so left is of varying density, but so far it is considered to be a sufficient cover to maintain the soil moisture. Expert opinion considers that the great danger in these moist evergreen forests is that if Clear Felling is resorted to and three years or so elapse before a protective cover is obtained the upper layers of the soil become dry and the water table is lowered to such an extent that the young seedlings are unable to get their roots down into the moisture and so fade away in the hot weather. An overhead cover or shelter wood is therefore required. It is too early as yet to state on what principle this will be removed. After the felling in some areas the natural regeneration of the more valuable



EVERGREEN FORESTS, CHENAI NAIK, PALGHAT, MADRAS PRESIDENCY UNFELLED FOREST IN THE DHON VALLEY, 1925



EVERGREEN FORESTS, CHENAI NAIK, PALGHAT DIVISION. THE APPEARANCE OF THE COVER LEFT AFTER THE FELLINGS HAVE BEEN MADE. THIS PHOTOGRAPH AND THE ONE ON THE REVERSE SIDE WERE COLLECTED BY THE AUTHOR DURING HIS VISIT TO THE AREA IN

species may prove sufficient to produce a full crop when combined with inferior species which will come in of themselves. In other cases the valuable species are deficient in the old crop, and consequently the regeneration of the area has been assisted artificially by planting in seedlings at stake in lines. These are put in at 6 feet apart in the lines and 6 feet apart between the plants. Sowing was also resorted to and experiments with both were being undertaken. A considerable amount of weeding is necessary. At the present time (1925) the Divisional Officer is planting *Hopea parviflora* and *Artocarpus hirsuta* 19 feet by 19 feet apart. After a recent inspection of the work in Chenat Nair and in Coorg the Chief Conservator issued an order (March, 1925) that artificial cultivation in advance of exploitation fellings was to be stopped, since it appeared that the natural regeneration obtained was sufficient to produce a future crop. That in cases where this was not the case he considered it would be easy to bring in *Hopea* and *Artocarpus hirsuta* under the cover left on the area after the fellings. The species of chief value are *Calophyllum tomentosum*, *Hopea parviflora*, *Artocarpus hirsuta*, *Terminalia tomentosa* and *Acrocarpus fraxinifolius*. The cost of artificial work is high and the weeding is heavy, but the work is still in the experimental stage in this respect, and therefore the question of the ultimate cost has yet to be ascertained. *Hopea* is considered to be one of the most promising species; but the tree of the area as evidenced by the magnificent specimens seen standing in 1925 in the old forest (in the Sappal Valley for instance) is the *Calophyllum*. A tree measured here was 11 feet 10 inches in girth at breast height with a clear cylindrical bole of 75 feet to 80 feet. In one spot what was almost a clump of these wonderfully fine great trees was seen. This tree yields the poon spars of commerce (used for masts) so often mentioned in the early reports on Madras Forests. Its chief rival in this respect is the *Acrocarpus fraxinifolius*, the "white cedar." This species has enormous buttresses here which it is hoped may have a commercial value. Some of the sample plots alluded to above date from before the present method of exploitation commenced or were marked out at the time. They were in some cases designed to ascertain the amount of shade, if any, required by the young evergreen seedlings. Present opinion inclines to a comparatively light cover being all that is necessary, and the Forest Engineer at the request of the Chief Conservator has undertaken to fell, after exploitation of a

coupe, some of the standing material where the cover appears too dense.

5. *The System in Coorg*.—Some considerable experience had been gained in Coorg with the exploitation of evergreen forest. The present Chief Conservator had been in charge of the Coorg Forests for several years, and therefore considerable interest attaches to the summary of the regeneration problem of this type of forest contained in his Note (Proceedings, Mis. 66, dated 2nd March, 1925) on "Cultural Operations in Chenat Nair and Coorg" which has already been briefly alluded to. The following extracts explain the Chief Conservator's views :

"Recent inspections of exploited evergreen forests in Coorg and Chenat Nair have convinced me that the advisability of undertaking cultural operations in advance of exploitation fellings is at least open to question. In the Barapola Valley in Coorg fellings were carried out above Sollekolli between 1920 and 1922. These varied greatly in intensity, as it was desired to determine how much of the old crop it was necessary to retain in order to provide sufficient shade for the protection of the natural regeneration until it became established. In the area (above the Karihole) where the felling was most severe the number of seedlings does not appear to be much less than where a very considerable portion of the old crop was left standing ; the young crop, at all events, is sufficient to ensure a fairly complete stocking. In this area the felling was more severe than those in the recently exploited areas in the Chenat Nair Forest, but considerably less so than the fellings carried out there in the first year." The latter allusion is to the Clear Felling at Fishers' burn already described. In the case of the former areas the Chief Conservator adds: "While, except possibly in some places, there is a sufficiency of seedlings in the areas felled in the two following years." He continues: "There would appear therefore to be a very fair probability that nature will provide all that is required in the way of a new crop after exploitation in the evergreen forests, more especially in view of the fact that it has now been found necessary to leave a considerable number of trees of the old crop standing as, owing to unsoundness, it is impossible to utilize them profitably."

"Cultural operations carried out in advance of the fellings may possibly in some cases result in the formation of a more complete crop than that obtainable from natural regeneration, but such operations must be costly." He also considered that

the danger to the young crop during the exploitation would be very heavy especially on steep hill-sides. "For the foregoing reasons," wrote the Chief Conservator, "I consider that there is not sufficient justification at present for incurring further expenditure in extending the cultural operations undertaken in recent years in the Papanasam and Chenat Nair Forests, in woods not yet exploited." It should be added that opinions differ, some considering that regeneration should be undertaken either ten years before or after the fellings.*

VI. IMPROVEMENT FELLINGS

The old method of so-called Improvement Fellings, under which the best trees in the forest, above a fixed girth limit, were taken out at each visit and the unsound and inferior or unsaleable species left, had persisted throughout the greater part of India up to the close of the last century. Under what may be termed the renaissance of silviculture it has to a considerable extent disappeared. This antiquated method, which was dignified by the name of "Selection" both in Europe and India, had little in common with the modern Selection System. Unfortunately there are still forests in India where this old method, perhaps under a thinly veiled disguise, is still in force either through ignorance or the desire to make revenue. The

* The following is worthy of mention. In the two divisions of South Kanara considerable attention is being given to the regeneration of *Hopea parviflora*. Previous to 1920 spasmodic attempts had been undertaken, with few results. In 1920 large areas in accessible localities were selected in both Divisions, and sowings of valuable evergreens, such as *Hopea*, *Artocarpus hirsuta* and *Vatica (Vateria?) indica* were commenced in the rains and have been continued to date. Out of a total of 6370 acres selected (1924) 5874 are considered to be fairly well regenerated. These forests had suffered severely in the past from shifting cultivation, but had improved under protection since the practice was stopped and evergreen undergrowth had come in, which is essential to afford shade to *Hopea* seedlings. At first lines were cut 12 feet apart and seeds were dibbled in at stake along the edges of the lines. In 1922-3 the lines were replaced by well-dug pits, 28 feet apart, 40-50 seeds sown per pit. The spacing was subsequently reduced to 9 feet by 9 feet. Both size of pit and spacing are still the subject of experiment. Up to 1924-5 the sowings preceded timber fellings, no cuttings of any kind being made in the overwood. The sowings in some cases are now being made in felling coupes, and the method practically amounts to a modification of the Uniform (or even Group) System, or to Selection Fellings, the necessary overhead cover being maintained for the *Hopea* seedlings, this species now being the chief one used. It has not yet been decided as to how or when the remaining overwood shall be removed. Including cleanings, filling up blanks, cost of nurseries, the cost of 6149 acres (up to 31-3-1925) amounted to Rs.33,254. A certain amount of work has also been carried out to assist natural regeneration of *Hopea* in two reserves, Jalsur East and Nalkur. The progress of this work will be watched with interest.

reason of its persistence is usually easily ascertainable—the absence of a Working Plan controlling the correct exploitation of the area of forests or the existence of Working Plans of considerable antiquity whose utility, at no time great, has long since disappeared.

The modern idea of Improvement Fellings has little in common with the old. In the above sketch of the departures being made in most Provinces from the old Selection System of management it will be realized that the work initiated with such favourable results can only proceed slowly. That a long interval of time must elapse, even under the most favourable circumstances, before the forests of a particular species or type in a division pass through a high forest rotation. Periodic Blocks I and II may have been decided upon, but the rest of the area must be still dealt with under the Selection System by what are now designated as Selection-cum-Improvement Fellings; and provided such fellings are carried out in a scientific fashion it should be possible to considerably improve the existing growing stock, whilst at the same time marketing that part of it which cannot hope to remain sound until the area comes into Periodic Block I. These fellings also envisage getting rid of the hollow trees which previous exploitations of the areas usually left untouched, to the detriment of the younger-age classes in their neighbourhood. As examples of the new ideas on this subject the method of carrying out Improvement Fellings in Burma and the Central Provinces may be cited.

In Burma.—Allusion has already been made above to the fact that the Local Government issued orders in 1906 curtailing *taungya* plantations. This order resulted in a great impetus being given to Improvement Fellings. Large areas were worked over by this operation, though much of the work appears to have been of rather a perfunctory nature in many Divisions, as the following figures for the Province indicate: 1907–8, 90,000 acres cost Rs.28,256, or 5 annas per acre; 1908–9, 78,195 acres cost Rs.36,028, or 7 annas per acre. Work on these lines continued for several years. It was during the period, however, and as an outcome of this work, that it became recognized that under the Selection System improvement fellings should be divided into two classes, the one designed to help the larger trees of the more valuable species, which were termed “O” Fellings; the other to assist natural reproduction of the valuable species and, if possible, to induce



THE 1915 IMPROVEMENT FELLING AREA SHOWING FINE GROWTH OF TEAK
AS A RESULT OF THE FELLING. PHOTO. TAKEN NOVEMBER, 1922. KATHA
DIVISION, UPPER BURMA

H. R. Blanford, photo.



INSPECTION OF ELEPHANTS AND KIT AT HMYCHAUNG FOREST RESTHOUSE,
THARRAWADDY DIVISION, BURMA, FEBRUARY, 1925

Photo. by Author



A TEAK PATCH, 2 MONSOONS OLD, AVERAGE HEIGHT 4 FEET. AFTER THE
COMPLETION OF FELLINGS, WHEN ALL THE SALEABLE MATERIAL HAS BEEN
REMOVED, THE FELLING DEBRIS IS STACKED INTO HEAPS AND BURNT. IN
THE BURNT PATCHES TEAK SEEDS ARE DIBBLED JUST BEFORE THE MONSOON.
THE PICTURE SHOWS AN AVERAGE OF SUCH PATCHES. NORTH DANGS,
BOMBAY PRESIDENCY

further natural regeneration, termed "Y" Fellings. Considerable work had been undertaken, especially under the "Y" Fellings, by the time the Burma Forest Conference met in 1910. At this Conference it was agreed that fellings of the latter type should be concentrated and repeated till their object had been attained. Blanford, in the Memorandum already referred to, thus describes the progress made: "For several years Improvement Fellings, more especially of the 'Y' type, were carried out over considerable areas (93,143 acres costing Rs.55,409, or almost 10 annas per acre in 1913-14, and 134,047 acres costing Rs.78,928, or 11 annas per acre, in 1914-15) and with increasing intensity, culminating in what amounted to a regeneration felling in the Saing Yane Forests of the North Toungoo Forest Division in 1916. Here the felling consisted of a complete removal of all trees except seed-bearers of teak and *pyinkado*, and a clear felling of all bamboos and undergrowth followed by as complete a burning as possible. Natural regeneration was on the whole good, but rather uneven, and depended naturally on the proximity of the seed-bearers. The cost approximated, or was even slightly higher than, the cost of a good *taungya* plantation, although the stocking under this method of regeneration could not compare with a fully stocked plantation.

Previous to taking over charge of the North Toungoo Division, Mr. Walsh had been in charge of the Tharrawaddy Division and had there commenced a series of heavy Improvement Fellings in favour of young *pyinkado* regeneration. *Pyinkado* regeneration was found to be very plentiful in a type of lower mixed forest known as *thitkyin* which was characterized by the absence of bamboos. These Improvement Fellings commenced in 1910-11, and work continued for several years with a view to establishing the natural regeneration of *pyinkado*. By 1917 this had been attained over considerable areas, but the results were somewhat uneven and could not compare either in cost or results with a good *taungya* plantation.

With the advent of the Clear Felling System with artificial regeneration with *taungyas*, 'Y' Improvement Fellings as a class have ceased to exist. In the meantime little progress was made with the other class. A certain amount of work was carried out in some Divisions, but this usually, with the exception of those in the Upper Chindwin, consisted of the sacrifice of trees of all species in the interest of teak. This in accessible areas where the timber was exploitable could not be justified.

In the Upper Chindwin Division, however, Improvement Fellings, combining the two classes 'O' and 'Y' Fellings, have for many years been undertaken with considerable success, but the forests in this Division are so inaccessible to the extraction of any timber other than teak that the extermination of other species in the interests of teak is entirely justifiable. With the advent of the Uniform System the class of fellings previously called 'O' have assumed considerable importance. In areas worked under the Uniform System these fellings are increasingly important in areas which will not be regenerated until towards the end of the rotation. Moreover, under the present policy all less accessible forests will continue to be worked under the Selection System, and Improvement Fellings are essential after extraction of teak in order to maintain or increase the proportion of teak in the forest. It naturally follows that when one species in a mixed forest is being exploited it is essential to cut out an equal proportion of the other species in order to maintain the relative density of the species which is being exploited. The present policy, therefore, is to carry out Improvement Fellings following the extraction of teak in Selection Working Circles and of all species in areas in the concentrated regeneration Working Circle which do not fall in the regeneration block and have been worked by Selection. The class of Improvement Fellings now being carried out in the Selection forests is a combination of the 'O' and 'Y' Fellings. Apart from climber cutting, which is carried out over the whole area if possible, Improvement Fellings are concentrated on the more valuable teak-producing forests and consist in a removal of mature trees of the less-valuable species on at least a similar scale to the extraction of teak and the more valuable species, a thinning and cleaning in the older-age classes and a concentration of bamboo cutting and clearing over groups of reproduction and saplings." In some cases improvement fellings directed to assist saplings have proved very useful six or seven years after the bamboo has flowered, especially in the case of *tinwa* (*Cephalostachyum pergracile*).

In the Central Provinces.—In its sylvicultural practice the Central Provinces is admittedly in a state of transition. When the system of Coppice with Standards came into vogue towards the end of last century considerable areas in these Provinces were placed under this system. The Working Plans at the time were poor in quality and based on insufficient data, and



NATURAL REGENERATION OF TEAK DATING FROM CLEAR FELLING IN 1911. PHOTO. TAKEN NOV. 1915.
COMPT. I, HILUMVO RESERVE, KATHA. U. BURMA

Photo. by H. R. Sanford



PHOTO. TAKEN NOV. 1916. TUNGJI WITH NATURAL REGENERATION. PADIY REAPED "IN FORE-GROUND,
NOT YET REAPED IN RIGHT BACKGROUND. GIRDLED TEAK-STILL STANDING. COMPT. I, BILUMYO RESERVE,
KATHA DIVISION, BURMA

Photo. by H. K. Blanford

the Province, so far as the practice of scientific forestry was concerned, was in a very backward state. Of late years a marked change has come over the administration, and perhaps nowhere more so than in the question of Improvement Fellings and Thinnings. The history of the forests of the Central Provinces (cf. I, p. 394) will have made it evident that the Department took over large areas, especially in the teak regions, which were in a ruined condition. For years little was done sylviculturally. The small staff was fully occupied with demarcation and protective duties, and these more or less completed a period of stagnation ensued. Then came the introduction of the Coppice with Standards System in many Divisions, which, as in Bombay, was subsequently found to be a mistake when indiscriminately applied to large areas. In the localities in which this system had been in force for ten to twenty years the present policy prescribes that such areas should be visited in the order laid down in the Working Plans, and that careful thinnings should be made in the young coppice crops, which are to be grown on to high forest, though whether even or uneven aged has not been determined; and at the same time that the standards should be removed according to the yield prescribed by felling the saleable species, and girdling or lopping unsaleable species. In former times the "mohwa" tree (*Bassia latifolia*), under orders of Government, had always to be reserved owing to the value set upon the collection of its flowers by the people. The consequence of an order thus issued, without reference to sylvicultural necessities, the extent of the population, or the numerical proportion of the species in the forests has been that the latter are full of old trees with wide-spread crowns which are occupying in the aggregate a very considerable acreage, whilst impeding the growth of young trees in their neighbourhood. The fallacy of such an order has now been realized, and it has been modified to the preservation of *mohwa* trees only in the vicinity of communities who are in the habit of collecting the flowers. But the problem as to the best method of getting rid of the large number of useless trees is a serious one; the cost of merely felling them is not inconsiderable.

About 1912 Mr. Dunbar-Brander made a Working Plan for the Bori Forest (II, p. 224) with two felling series. This Forest was not under the Coppice with Standards System. The ten years' prescriptions were based on felling all trees 6 feet and more in girth. At the end of the period all trees of this girth

had been extracted. It was then proposed to lower the felling girth to 5 feet. Sir Henry Farrington, Bart., the Chief Conservator, who has been responsible for the recent marked progress in parts of the Province, would not consent to this, and rightly so. The forest was mainly of coppice origin, and it was laid down that one of every two coppice stems on a stool should be cut. Since the crop had grown up densely this operation could be safely carried out.

Other areas of forest outside the parts which had been placed under Coppice with Standards are now being worked under what may be termed the modern Improvement Fellings, though the introduction of the method is of recent origin and its application in the Northern Circle has made little headway. These fellings include the selection of mature trees, teak and other species, for felling with thinnings and cleanings in the younger age classes. The actual state of the forest varies a great deal since a large amount of young growth has come up in some parts of this great forest region during the sixty years which have elapsed since the Forest Department commenced its introduction of protection. The Chief Conservator is aiming at having this work carried out departmentally wherever possible, as he considers that it is done more expeditiously and efficiently by the Department, whereas a Contractor may (and has in the past) spend several years in a compartment or coupe. With the exception of South Raipur, which is being exploited under a new Working Plan, the future system of management of the forests of the Province is undetermined. The Periodic Block is almost unknown and the position of Working Plans is most unsatisfactory. The fact that the junior officer wonders what he is working for is understandable.

The Improvement Fellings and Thinnings involve the selection and marking of individuals for felling or girdling, the lopping of inferior species interfering with the more valuable ones, the thinning of stands of dense pole growth and of coppice clumps, and the removal of one of two coppice stems on a stool. From the work already carried out, though it is in its infancy, it has already become apparent that the crops can be immensely benefited by such operations provided—and this is the important factor—it is carried out by officers who thoroughly understand the principles of thinning. And even then the work is difficult, since the degree to which the canopy should be opened out in the various age classes is still

incompletely understood. Climber cutting has to be added to the operations undertaken. The author had an opportunity of seeing some of the work of this kind in the fine Allapilli Teak Forests (II, p. 238) of South Chanda, in company with the Chief Conservator. This forest is under a Working Plan. There are two Working Circles. Working Circle I is being worked under final fellings combined with Improvement Fellings, thinning of young teak pole clumps and the cutting back of all young teak damaged in the exploitation. Tending operations will be carried out in the exploited coupe till the new crop is established. In Working Circle II Improvement Fellings are being undertaken. These operations entail leaving a sufficiency of old teak for the exploitation fellings when those reach this Working Circle. The marking of an Improvement Felling immediately precedes the removal of the marked trees, the marking officer having with him a gang of fellers. The operation witnessed was being conducted as above described, but its delicate nature was easily apparent; the work calls for the highest skill of the Forest Officer. The procedure of necessity varies from place to place. For instance, if a junior inexperienced officer is entrusted with the work, and told to leave all the teak or only mark very sparingly in teak, he may easily partially ruin an area. Teak does not grow pure in these forests. Its associates, *Terminalia tomentosa*, *Anogeissus latifolia*, *shisham* and *pyinkado* (both the latter in foliage for a portion of the time the teak is leafless during the hot months), etc., require to be retained in a proper proportion in order to assist in drawing up the teak. Pure young pole stands of teak require the most careful thinning and so forth. All these problems and others presented themselves to us that morning. There appears little doubt that if the operation is successfully undertaken over all the areas which require it the Central Provinces should possess in the future as valuable a forest property as exists in India. To assure this result will, in the author's opinion, necessitate the Province entrusting the work only to efficient officers.

SOME GENERAL REMARKS IN CONNECTION WITH SYLVICULTURE

The one factor which, as a result of the author's tour round India, stands out above all others as an issue requiring a definite solution in almost every Province is the question of the agency by which the crops now being regenerated under

the concentrated methods, or the far wider areas still under the Selection System, nominally or otherwise, are to be scientifically thinned (cf. II, pp. 590, 591). In some Provinces the remark was heard that the Department was over-staffed. It appears to the author, and he puts forward the suggestion for consideration, that once the question of the work which the future thinning of the crops, the new forests now being grown, will entail is properly envisaged a very much larger staff will be required to cope with it. Every Forest Officer will admit that the crops now being raised in the concentrated regeneration areas will require early and fairly constant thinning. It has been said that this work can be done by what are termed "mechanical" thinnings, a term and operation which imply a negation of all true silvicultural science. An untrained man, or in any event a man inexperienced in thinning work, is given a 6-foot stick, or such other dimension as may be aimed at, and told to only leave the trees standing at this interval. The author has recently seen a good many young crops in India into which the entrance of the man with the stick combined with its use for a couple of hours would mean their ruin. The case of the perfectly regular plantation, where such a method would be of service to the amateur, is of such rare occurrence that it may be left out of account.

Investigation work has established the fact that young teak *taungya* plantations require thinning at a far earlier age than the fifteenth year prescribed by Leete for Tharrawaddy. Regular schemes for thinnings over whole compartments for five years combined with cleanings have been drawn up for the majority of Divisions in Burma. The adequacy of the work must, however, depend on the skill of the staff in this matter.

An interesting point which arose during visits to the new young crops was in connection with the time of the year at which the thinning should be undertaken. The author expressed the opinion that even with broad-leaved species in sapling and *young* pole forest the marking for thinning would be undertaken with greater accuracy if it were done when the trees were leafless. In the case of teak, once the canopy is developed, nothing can be seen of the interior of the forest from the outside and but little within. On the other hand, when the young trees are leafless a correct estimation can be formed of the stocking. Many Forest Officers will perhaps agree to this even though it may appear to be against text-book theories. To take the author's case; he saw many young plantations



ELEPHANT BEING USED TO THIN IN A YOUNG POLE FOREST IN THE SAUGOR
DIVISION, CENTRAL PROVINCES

A. H. Stein, photo.



A TYPICAL BLANK AREA IN SĀL FOREST IN SINGBHUM OWING TO PAST CULTIVATION OF FIELD CROPS. BIHAR AND ORISSA



YOUNG CROP GROWN FROM SHISHAM ROOT AND SHOOT CUTTINGS, TRANS-PLANTED ONE YEAR AGO, WITHOUT TRENCHES. DAPHAR, PUNJAB. (*Vide p. 1000*)

Photo. 1925 by W. E. Flewett

and natural areas of teak and other species in Burma, Madras, Central Provinces and Bombay on the recent tour. The remark was often made by the Forest Officer that it was a pity he was seeing the young crops "in their ragged, unkempt state." The allusion was to their leafless condition. They are prettier to look at when in full canopy, admittedly. But the trained eye of the Forester can see more and the visitor (or the thinning officer) can form far better conclusions when he has the good fortune to see the young crops in their leafless condition.

How is the problem of carrying out efficient thinning to be solved? In the author's view the Department is now faced with a position which has not arisen during the previous sixty years of its existence. Save in such small areas as Nilambur and Changa Manga, each of which has had a Divisional Officer and a considerable staff to undertake the thinnings at the proper time, and certain areas in the United Provinces and Punjab, this type of forest work which calls for, as we know, the exercise of the highest skill of the Forest Officer, has remained a dead letter. This history illustrates to the full the contention. We have the example of the scattered *taungya* teak plantations of last century in Burma which for the most part remained unthinned. It was due to the impracticability of properly thinning such scattered areas that *taungya* work was stopped for a time. The Department is now facing an entirely new problem. In the areas which for convenience may be placed together as under concentrated regeneration in one form or another, each year will see the addition of a considerable area of young crops. The thinning work which will have to be carried out will increase yearly, and it may be safely surmised that ten years hence it will in many Divisions form one of the chief preoccupations of the Divisional Officers and of the Conservators of the Circles.

So far as the Provinces are concerned it has become increasingly apparent that progress on the correct lines necessitates the appointment of a Provincial Sylviculturist, and for this post the very best officer of Deputy Conservator's rank is required. The Sylviculturist works under the orders of the Conservator of Working Plans and in collaboration with the Research Institute Sylviculturist. Most Provinces have made such appointments, Assam and Bombay being the only exceptions. The *taungya* plantation work in Bengal may be taken as an illustration of the importance the question of

thinnings has assumed. Here an entirely new type of regeneration work has been introduced into the Province. At Sukna and Toong, in Buxa (Rajabhatkhawa) and elsewhere in the Province there are young crops whose rapid development has already been commented upon. Most of these crops are, or soon will be, in urgent need of thinnings. It may prove possible with increased experience to sow less seed at greater spacing so as to be able to reduce this work in the earlier years. Success with thickly sown seed results in dense lines of young saplings which gives rise to contortion of the young stems to avoid which early assistance may have to be given by cleanings and light thinnings. With the rapid growth attained in this region experiments made by the Sylviculturist in sample plots with different intensities of thinning should yield, in a few years, a rough line to work upon for different species. The example is given as showing the urgent nature of this operation, and the increasing scale upon which such work will have to be undertaken with the annual addition to the area under young crops.

As important, and even of higher importance in some Provinces, e.g. the Central Provinces, is the question of the Improvement-cum-Selection Fellings now being rightly applied to the far larger area of forests in the country which are in such urgent need of the operation, and on which, in fact, the future success and revenue from the Forest Estate as a whole so largely depend. These fellings and thinnings bear no resemblance to the so-called Improvement Fellings of the past, with the exception of some of the work carried out in the fine forest areas in the United Provinces and Oudh and the Western Himalaya deodar forests, coupled with a few isolated instances elsewhere. The work involved is enormous and it demands skilled men. It may be suggested that until the Department itself has realized to the full the creditable position to which it has attained in this respect, that it is now indeed faced with the type of work which demands from the European Forest Officer in France and Germany the exercise of his highest skill, it is unlikely that the Civil Authorities and the Councils should be aware of the facts, which are sufficiently technical to justify the full weight of the expressed professional opinion of the Department being brought to bear on the subject. Will the staff be adequate to the task facing it ten years hence? Reorganizations, if the past is any criterion to the future, take about this time to put through. And at the present moment

some cadres are unfilled even in the Imperial Service, whilst the shortness of Rangers is notorious. If it is allowed, and few will dispute the point, that the Department in sylvicultural matters has made a gigantic stride forward in the last few years, the consequences in a near future require to be fairly faced now.

That certain amongst the Senior Officers and the Divisional Forest Officers are alive to the full significance of this matter the author, from personal discussions, is well aware. Apart from the question of a capable staff the point of the want of a market for the thinnings is often put forward. But this is not an argument to the Sylviculturist. And the answer is to be found in a paragraph in the "Annual Report of Forest Administration for the Punjab" (1923-4, p. 19) by Mayes, Chief Conservator. Dealing with the tending operations he writes: "There are still thinnings urgently required in several Divisions, however, and special attention will have to be given to them, more especially in Rawalpindi East Division. A common mistake has been abandoning Thinnings and Improvement Fellings on the ground that the produce cannot be sold at a profit; often these operations cannot be directly remunerative, but the ultimate effect on the value of a forest crop makes it imperative to spend money on their execution, and delay may be false economy."

It has been said, and it is a truism, that thinning work calls for the highest skill of the Forest Officer. This does not by any means necessarily imply that the work can only be done by the higher grades of officers. It is usually admitted that a real expert in this branch is born with an instinct, an aptitude, which quickly brings him into the front rank. But he has to begin by being instructed in the work. It is certainly the case that some Forest Officers, of all ranks, will never possess any aptitude for the work. Their operations will ruin or impoverish the areas in which they are performed. But the average man can be taught, and if the forests are not to be reduced in value instead of increased they require to be taught in increasing numbers. It is as useless as unfair to expect that a junior officer straight from Home, or from Dehra Dun or Coimbatore, can be given such work to do, and then be censured if the results are not satisfactory. Indian species naturally differ from those of Europe, and the necessary modifications, based on European practice, have to be made. The far larger areas also introduce difficulties in moving officers about. But it is not impossible

that in order to train his staff, for it is after joining a Division that they have to learn the art, the Divisional Officer in India might for a few years adopt the practice of a Divisional Officer (*Inspecteur*) in France. In the French Division the thinnings to be undertaken in any year are all laid down beforehand, sanctioned by the Conservator and a definite period between which they must be marked is fixed. The *Inspecteur* spends several days or weeks on the work. For any particular compartment he collects a couple or more of his Rangers and several Forest Guards—the number depending upon the size of the area to be thinned at the time. These men assemble at the appointed spot and the work is carried out by this force under the eye of the *Inspecteur*, who must enter up the register himself. During the past five years the author has attended many such parties and the acknowledged expert amongst them has as often been an old Forest Guard or Junior Ranger (*Brigadier*). But, and the point is an important one, these men have been *taught* by their *Inspecteur* in this very way. And the young officers joining from Nancy are taught in the same fashion. This important operation is shown and explained to the probationer-student and he carries out practical lessons in it under supervision. But it takes a varying period of years to become more or less proficient at thinning work. A youth of a year's service has not such experience. The author does not pretend to suggest the method by which the responsible officers on the spot will solve this problem. But coming back to India with, so to speak, a fresh eye, and, it must be admitted, with no real idea of the progress he was to meet, he would like to record the opinion forced upon him. Going from Province to Province it became more and more apparent that the chief work facing the Divisional Forest Officer in India at the present day and in future, preoccupied as he is and will be with many other matters, is this question of ensuring each year that the thinning work in his charge is adequately carried out by officers who know the business. Failing this, the future of the forests, and an increased revenue, is not being assured; and without such assurance the Forest Officer is no longer fulfilling his charge. For, as has been so often said, the Forest Officer thinks in centuries. Translated this means, if it means anything, that his first thought is the sylvicultural necessities of his young and middle-aged crops in order that in due season they may produce a full yield.

CHAPTER XVII

AFFORESTATION WORK IN INDIA

IRRIGATED AND NON-IRRIGATED PLANTATIONS IN THE PUNJAB AND UNITED PROVINCES

THE work in connection with the formation of plantations in India such as the Nilambur and Ootacamund plantations in Madras, the teak plantations in Burma and elsewhere, and the Changa Manga irrigated plantation in the Punjab, which form the classic examples of this branch of the activities of the Department in the past, has been alluded to in previous chapters. In two Provinces of India, the Punjab and the United Provinces, afforestation schemes have in recent years acquired a far greater significance in the economy of the sister Provinces as a whole.

It is proposed in the present chapter to review the remarkable development which has taken place, and the important part which the afforestation work is likely to have in the development of large tracts of country. A knowledge of the lines upon which the schemes are being undertaken should not only prove of service to other parts of India, but equally to other portions of the Empire where great canalization and colonization schemes are in progress, or where areas of barren and sun-scorched land may be made productive through afforestation.

THE IRRIGATED PLANTATIONS OF THE PUNJAB

Perhaps the first instance in modern times of a plantation of any size being formed with the aid of artificial irrigation is furnished by the Changa Manga Plantation which was started, as has been shown (p. 131), in 1866. The raising of trees by means of irrigation (i.e. canal water) had a much more ancient origin, and was probably a natural sequence to the earliest

construction of a canal system. That the first English rulers realized the advantages to be attained from, and the necessity of establishing, tree-growth in the plains of the Punjab is apparent from a Report written by the then Lieutenant-Colonel Napier soon after the annexation. This Report had reference to the Bari Doab Canal project of 1850, an extract from which has been already quoted on pp. 286, 287, in Volume II. Plantations were commenced on the canal. The question of the provision of fuel for the population, and a decade later for the steamers of the Indus flotilla, and still later for the new projected railways, gave to this matter an increasing importance ; although on the treatment of the *rakh* lands the Punjab Government did not see eye to eye with the forestry advisers, Brandis and Cleghorn (I, p. 492). Dr. Stewart, the first Conservator of Forests in the Punjab, submitted a Report on the supply of fuel for the Punjab Railway and the Indus steamers in 1864. He summarized the sources of supply as : (1) the outer ranges of the Himalaya, where a more or less permanent supply was available ; (2) Canal Plantations, to be created or further developed by Canal Officers, the work having been already commenced on the Bari Doab Canal ; (3) Railway plantations, to be formed as near fuelling stations as possible. The Secretary of State subsequently refused to allow the Railways to form their own plantations (II, p. 289) ; (4) The *Rakhs*, arid scrub forests. It was estimated that the *rakh* areas adjacent to the railway line would be " only capable of supplying the river steamers and Punjab for three years." The lines upon which Stewart and his successors dealt with the problem have been previously discussed. It has been necessary to recapitulate the earlier stages of this fuel problem in order that the significance of its later development may be appreciated. If the fuel requirements of the population, and the timber demands of the Public Works and others, chiefly provided from the hill forests be omitted, the three crucial factors dominating the position were the canals, railways and the Indus flotilla. The *raison d'être* of canal construction was to bring under cultivation, by means of irrigation, the *rakh* areas, a considerable proportion of which, though covered with a poor scrub forest, would become valuable arable land the moment water could be brought to them. Both the steamers and railways consumed fuel. It became obvious that in process of time the demands of the former would decrease whilst the latter would increase, although the rate of increase of the railway require-

ments was far from being realized, as the old Reports, which speak of one daily up and down train, and later three, forming the basis of estimation of the fuel supplies, readily display. That the Forest Department contemplated the growing of trees by the Canal Department as part of the duties of the Canal Officers was due to the fact that in these early days the former was chiefly preoccupied with the forests in the hills, as has been already described (II, Chap. VII). The increasing demands for fuel by the extending railway resulted in a great impulse being given to plantation work, and the *rakh* dispute (I, p. 495) was settled by the Government of India deciding in 1869-70 that all *rakhs* available for the supply of fuel should be made over to the Department. A new Plantation Division was formed and plantation work was concentrated (p. 131 *ante*). The Punjab had taken the first step in the path of future progress in this respect, and as the years went by the Changa Manga plantation had a world-wide notoriety amongst foresters. A considerable area of the *rakhs* was managed by the Department as fuel and fodder reserves, and the railway demands for fuel for their locomotives were fully met until, in 1905, wood fuel was finally replaced by coal, and an economic step, which had seemed unrealizable to the Engineers in 1865 (II, p. 285), became a reality. So far as the Forest Department was concerned the railways and steamers thus disappeared as factors of importance in relation to fuel supplies. The third factor, the canals, remained, coupled with the greatly increased demands of the population for fuel and timber. In the administration of the plains of the Punjab the Canal, in other words the Irrigation Department, had grown rapidly in importance, as in so arid a country it was certain to do. With the change in the type of fuel used by the railways the reason for maintaining a large area of *rakh* scrub forest disappeared. During the past twenty years, with the wonderful development of the irrigation works of the Province, an ever-increasing area of such land has been given up by the Forest Department and placed under cultivation. In other words, the colonization of the Punjab has made rapid progress. It is only a question of a few years before all the *rakh* areas taken over by the Forest Department in 1869 will have been handed back to the Civil Department to come under irrigated arable crops. During his visit to the Punjab in April (1925) the author was astonished by the great areas of golden crops he passed through, occupying lands which formerly he had known as arid scrub. The rate

at which these areas of "unclassed" *rakh* forest have been dwindling is shown from the following figures :

Year.	Lahore. Areas of <i>Rakhs</i> . Acres.	Montgomery. Areas of <i>Rakhs</i> . Acres.	TOTAL. Acres.
1894-5	1,95,294	4,85,879	6,81,173
1904-5	83,408	4,40,340	5,23,748
1914-15	65,557	1,47,900	2,13,457
1924-5	10,338	85,805	96,143

The great decrease of *rakh* forest lands under the Department from over 6½ lakhs of acres in 1894-5 to a little over 96,000 acres in 1924-5 furnishes evidence of the effect canal construction has had on the areas in the plains under the Department. The policy which was being followed was economically sound, since to retain any area under forest, whether scrub or timber, which can be made to produce food is, under most conditions, wrong. Also the success of irrigation schemes of any magnitude depends upon being able to place a considerable tract under crops. The mere fact of bringing extensive treeless areas under crops, which enables the settlement of a large and new population on the terrain, necessitates in its turn adequate provision being made for its requirements in fuel, timber and other produce of the forests. The Forest Authority in the Province realizes that as the new colonization progresses an increase is to be anticipated in this connection. Further, that cotton ginneries and mills are likely to arise with little way-side stations which rapidly become centres of trade, all of which will entail larger demands for forest produce. Further, that the plantations from which these requirements can be supplied cost little or nothing to Government to create, even during the process of formation, as will be shown later.

In order to appreciate the position of the Forest Department in this matter *vis-à-vis* the Irrigation Department, it will be necessary to review briefly the aims and policy of the latter Department, which is transforming extensive areas of the arid barren plains of the Punjab into wonderfully rich crop-producing lands. It would be difficult to find a finer instance of successful and far-sighted British statesmanship and administration than the transformation scene which has taken

place in the Province during the present century. A brief description of the canal policy will be attempted.

Omitting one or two of the earlier canal schemes such as the Sidhnai and others, the first of the large and more modern canals was the Lower Chenab. First proposed in 1875 the cost appeared excessive. A smaller scheme, framed in 1882, failed. Major Jacob was placed in charge of the 1889 project and soon suggested a larger project, which received sanction in 1892. The tract for which the canal was proposed is described "as one of extreme desolation. Water lay for the most part from 80 feet to 120 feet below the surface of the soil, while the rainfall was scanty and uncertain. With the exception of snakes and lizards the country was extraordinarily devoid of animal life. The vegetation consisted of dusty shrubs and grazing was almost absent. The only inhabitants of the country were the indigenous nomads, a spare and hardy race who eked out a precarious existence by means of their camels and goats, being almost independent of any form of diet other than milk. Such was the country in which the Engineers were destined to live and labour for many years, and which the Lower Chenab Canal has converted from a wilderness into a garden." This description equally applies to many other areas which have been, or are to be, reclaimed by canals. The immediate success of the earlier colonists on the Lower Chenab with their crops gave rise to a great demand for the land. A railway for the carriage of the produce was commenced in 1895, roads came rapidly into being and towns and factories began to spring up in the former desert. In ten years the population of the tract had risen from 8000 to 800,000. Lyallpur, the capital of the colony, is now an important city with an enormous export trade. In 1919-20 the value of the crops grown on the land irrigated by the Lower Chenab Canal was no less than Rs.16 crores or nearly five times the capital cost of the work. Thirty years earlier this land was practically valueless. The Lower Jhelum Canal was commenced in 1888, but was not opened till 1901 and completed in 1908. All previous irrigation works were, however, outdistanced by the great Triple Canals project which is the largest irrigation work executed in India to date. Its main object was the irrigation of a tract of country known as the Lower Bari Doab, situated between the Ravi and Sutlej Rivers. Briefly, by means of the scheme framed, the surplus water of the Jhelum River is transferred into the Lower Bari Doab. The professional skill displayed in

handling this project has now become evident, since it has made possible a subsequent undertaking that of the Great Sutlej Valley Canal project. The details of these schemes are described in *The Land of the Five Rivers* (Lahore, 1923) to which the reader is referred. It will suffice to say that had the Sutlej water been taken into the Lower Bari Doab, as at first proposed, development of irrigation in the Sutlej Valley would have been at an end. Each section of the Triple Canal Scheme (which was sanctioned in 1905) was opened as finished, the Upper Chenab Canal in 1912, the Lower Bari Doab Canal in 1913, and the Upper Jhelum Canal in 1915. The total area commanded by the project is 4,000,000 acres. The Sutlej Valley project is a direct outcome of the great Triple Canals project. The total area to be irrigated is 5,000,000 acres, and the total estimated cost amounts to Rs.14½ crores. The Secretary of State sanctioned the work on December 9th, 1921. Several other projects are under the consideration of the Government, viz. the Bhakra Dam project, the Thal Canal project and the Haveli project. The Bhakra Dam project provides for the construction of a reservoir dam 400 feet high on the River Sutlej at Bhakra, where it finally debouches from the Himalaya. The capacity of the reservoir will be 120,000 million cubic feet. The magnitude of this project becomes evident when it is contrasted with the Assuan Dam across the Nile which impounds only 36,000 million cubic feet of water. Modern canal engineering has developed in India, and the highest technical skill is, the experts consider, brought to bear on these great Punjab projects. With this brief review the forestry aspects of the question will be discussed.

It has been said that the Forest Authority is alive to the necessity of providing the necessary forest produce for the new canal colonies. With this aim in view Pir Mahal in the Multan district, of 45,000 acres, was constituted a Reserved Forest in 1908-9 in order to create an irrigated plantation. Kot Lakhpat, of 1900 acres, near Lahore, was opened in 1910 for the same purpose. The commencement of the work in Pir Mahal was delayed on account of lack of water, and it was later finally decided for various reasons to abandon the area altogether. Kot Lakhpat was proceeded with and did exceedingly well. Mayes, the Conservator, took the author to see it in 1925, and it appeared to be a most promising young plantation. Unfortunately all the trouble and work the Department have put into this plantation will be lost owing

to what can only be termed an unfortunate decision of the Government to hand over the area to a local body for the creation of a model town. The Chinchawatni Plantation of 12,000 acres was commenced in 1912-13, and Khanewal, of 19,000 acres, was reserved for the formation of irrigated plantations in 1914-15 in order to supply the requirements of the colonists on the Lower Bari Doab Canal, then recently opened. In 1919 Daphar, 7900 acres, was opened on the tail of the Upper Jhelum Canal. A small plantation of 800 acres, the Tera, was also commenced in 1916-17 for the purpose of supplying the Jallo Rosin Factory with fuel. Finally, the Punjab Government have definitely promised the Department 30,000 acres on the New Sutlej Valley project, and investigations and proposals regarding these sites are being made. It will be obvious that with the further development of the policy and projects of the Irrigation Department additional areas of plantations in the plains will become necessary. In fact it is perhaps not unreasonable to forecast that the bulk of the work of the Department in the plains will be plantation work, that an important and valuable part of the administration will shift from the hills to the plains, and that a definite portion of the Punjab staff will become specialized as plantation officers. With the experience already gained it appears uncontroversial that the plantations will be both economically and financially a most valuable property.

Allusion has been made to the fact that the cost of formation of the plantations is small. When the Government has transferred a definite area to the Department upon which a new plantation is to be created, temporary cultivation is continued on all suitable portions of the terrain which have not been afforested or are not being planted in the year, the revenue from such cultivation being credited to the Forest Department. The sums thus accruing may cover or nearly cover the cost of formation.

Before proceeding to a general review of this plantation work the following summary by Mayes may be quoted: "There are now five irrigated plantations in the Province against one in 1901, and three more are likely to be started soon, for which sites are being selected on the new Sutlej Valley Canal area. These plantations are very satisfactory, both from the point of view of the Government and the people. To the former they are good paying concerns, while to the latter they are good sources of supply of firewood and timber at reasonable rates.

The areas and years of commencement are given below :

Plantation.	Area sown up to 31st March, 1924. Acres.	Total Area. Acres.	Year of com- mencement.
Chinchawatni. . . .	2,976	11,539	1913-14
Khanewal	8,177	19,205	1916-17
Tera	181	837	1916-17
Daphar	1,372	7,212	1918-19
Shahpur Jand Extension (Changa Manga) . .	604	1,223	1920-1
	<hr/> 13,310	<hr/> 40,016	

In addition, the old Changa Manga Plantation amounts to over 12,000 acres.

The following note, descriptive of the modern practice of formation and tending of irrigated plantations in the Punjab, was drawn up for the author, with the Chief Conservator's assent, by Mr. W. C. Flewett, Deputy Conservator, in charge of the Northern Plantation Division. The author had the company of this officer during his visits to the Changa Manga, Chinchawatni and Khanewal Plantations; as also in the two latter, of the officer in charge, S. Bahadur Singh and his Assistant Fakil Chand. He would like to express his appreciation of the zeal and enthusiasm exhibited by the two Indian officers. Fluett deals with his subject under the heads: Selection of Site, Layout of Plantation, Raising the Crop, Tending and Irrigation, as follows :

“ Site.—(1) The site should be as near a railway station and the market as possible. (2) The site should be well commanded by the canal with the minimum area of high ground and minimum area of *chhapar*, i.e. low-lying depressions where the soil is generally acid and incapable of supporting vegetation during the first rotation. (3) Both *rabi* and *kharif*, i.e. winter and summer water, should be available if possible, because if *rabi* water is obtainable temporary cultivation of unplanted areas is much more profitable—higher revenue can be obtained during the process of formation, thereby lowering the initial cost. (4) A water supply capable of giving a delta of 5 feet of water during the irrigation season should be available. If possible 3 feet to 3½ feet of this should be available between 1st April and the 30th June to enable irrigation to be carried out freely and expeditiously during the hottest months when



AREA TRENCHED AND READY FOR SOWING. CUT COTTON STOCKS LYING IN FOREGROUND. DAPHAR PLANTATION, PUNJAB

W. E. Fissett, photo.



REOPENING TRENCHES AT CHANGA MANGA AFTER FELLING. ROOT AND SHOOT CUTTINGS AND SOWINGS WILL BE CARRIED OUT HERE. 1925, PUNJAB



SHISHAM CROP ESTABLISHED ON VERY BAD KILLAR SOIL BY THE METHOD OF
ROOT AND SHOOT CUTTINGS. SOWING HAD REPEATEDLY FAILED. IRRIGATED
PLANTATIONS, PUNJAB, 1925. S. BABUR SINGH IS IN THE PLANTATION

Photo. by W. E. Flavett.



SHISHAM SOWINGS SOWN APRIL, 1924. PHOTOGRAPHED APRIL, 1925. DAPHAR
PLANTATION, PUNJAB

W. E. Flavett, photo.

it is most required. The amount of water supply actually required can only be found by experience and varies with the texture of the soil, local rainfall and depth of the water-level. In Chinchawatni and Khanewal, where the soil is sandy, rainfall very low and sub-soil water-level very deep, a minimum of 5 feet is required. In Daphar, where the rainfall is higher, subsoil water-level 20 feet to 24 feet from the surface and the soil with comparatively high water-retaining capacity, a very much less depth is required, but insufficient data are as yet available to show what the requirements of this plantation really are. (5) The soil should have a moderate admixture of clay and should be of good depth. The water consumption of a coarse sandy soil is very much greater than that of a more clayey soil. The water-level should not be too deep, because the nearer the subsoil water the sooner do the roots of the trees obtain another source of water-supply on which they can depend in the event of canal shortage or failure. On the other hand, the rise of the water-level throughout the Doabs in the Punjab is more or less general, and it must be remembered that as soon as the water table reaches to less than 10 feet from the surface the evaporation of the water from the surface—to which it rises by surface tension—becomes considerable, and this goes on continuously till the surface layers of the soil become saturated with *kallar* (salty). Areas would, of course, be selected having the minimum of *kallar* soil in them. (6) The selected area should be self-contained and as near the shape of a square as possible. If this can be arranged the lengths of irrigation channels required are reduced to a minimum and supervision is facilitated.

Layout.—The design of the main water channels of a plantation is drawn up by the Canal Department. The main distributary channel and the *chak* channels are dug by them and the whole area is split up into either rectangles or squares of 50 acres or 25 acres each, depending on the sizes of compartment required by the Forest Department. A copy of the contour map, according to which the design is drawn up and on which the compartments are shown, is handed over to the Forest Department. The layout of the irrigation system in the compartments is arranged and dug by the Forest Department. The area to be taken up in any year is handed over by the temporary cultivator about the end of February or March, when his cotton should be off the ground. The area is examined, special regard being given to the run of the contours, and the

proposed layout of the trenches and *khals* is drawn on a large-scale map which is approved and signed by the Divisional Officer. Digging then commences, and the ground should be ready for sowing by the 1st of April, when also the summer (*khari*f) irrigation supply becomes available. The trenches run from *pasel* to *pasel* at right angles to the *khals*, being spaced at intervals 10 feet apart. Past practice has been to dig the trenches 1-foot wide by 1-foot deep, but experiments are now being carried out to reduce the depth to 6 inches with a view to effecting economy of water, and the results so far are very encouraging. The *khals* need not be dug right up to the end of the compartment because, when irrigating, water is given to ten trenches at a time—the end of the *khal*, therefore, need only run to a point 100 feet from the lower end of the compartment. Ten feet should be left between the edge of the *khal* and the *pasel* to allow of space for the deposit of silt cleared from the *khal*. This silt, if spread neatly, forms an excellent inspection path. Sowings are carried out on the *pasels* on either side of the *khals*, but not on the banks of the *khals* themselves, where the stems and roots would later interfere with the passage of the irrigation water and impede the clearing of silt. The trees growing on the *pasels* soon close over, after which *kana* growth on the banks of the *khals* need not be feared.

Raising the Crop.—It has been the practice in the past to begin the plantation by raising *shisham* because, in the first place, it is easy to raise, and, secondly, mulberry generally begins to appear of its own accord shortly after the canopy has closed. Also success in raising mulberry without a humus soil and a certain amount of shade has not yet been recorded.

Raising Shisham from Seed.—Seed is generally collected from the isolated trees along the canal banks, and this method is convenient because of the easy passage of the bullock carts under the trees. The amount of seed required is about 20 *seers* per acre. When the ground has been in the hands of the temporary cultivator, he will have cleared away his cotton stocks by the end of February, and should have the ground trenched and completely ready for sowing by the beginning of April. The seed is sown along the edges of the trenches and the spoil earth thrown up alongside them. The seed should be sown low enough to be kept continually moist by the absorption from the water running in the trenches. If the seed is sown too far up the ridge to receive sufficient moisture,

or too far down to be flooded by the water running in the trench, germination is less favourable. Germination takes place in about from seven to ten days, and the lines should be lightly irrigated about every five days until this takes place. Sowings in Daphar, where the weed growth is dense, have often to be weeded twice during the first season. Unweeded sowings show very poor growth, where they are not actually killed out. The best time of sowing has been found to be early in April. Sowings should not be delayed till later than the beginning of May if possible, because the earlier they go in the better able are they to withstand the monsoon weed growth. Sowings made as late as July rarely attain to more than 2 or 3 inches in height during the season.

Method of Root and Shoot Cuttings.—Any crop of *shisham* must, of course, in the first place be raised by seed, but it has now been definitely established that by transplanting *shisham* in the form of root and shoot cuttings the crop can often be raised in places, e.g. *kallar* or salty soil—where the seed will not even germinate, and also in other places with greater certainty of success. To make a *shisham* cutting, a seedling plant about 2 feet high, with a diameter at the collum no thicker than the thumb and no thinner than the little finger, is dug up. The root is cut off to a length of 9 inches and the shoot to a length of 2 inches from the collum, making the whole about 11 inches long. The side roots are trimmed off to about 1 inch from the tap root. The trench in which the cutting is to be planted has small slots cut in one side of it, the slot being cut to the same depth as the bottom of the trench. The trenches are now filled with water for twenty-four hours, after which the ground is generally soft enough to enable the root and shoot cutting to be just pushed in like a paddy (rice) plant. The cutting must be planted in a slot to enable the trenches to be cleared in subsequent years without damage to the plant. The following points indicate the advantages of the root and shoot cutting over direct sowings in situ : (a) Failures can be conveniently withdrawn immediately after death and replaced by new individuals. (b) Root and shoot cuttings can be put out at any time of the year, provided there is water available. (c) Seed will not germinate in ground hostile to its germination, as in the case of *kallar* (salty) soil and *chhapar* soil (i.e. acid low-lying ground which buffaloes have previously used for wallowing). But the base of the root and shoot cutting, being already 9 inches below

ground, meets with less concentrated solutions of salts and has, in any case, sufficient stored energy to send its roots down to more suitable feeding ground. Root and shoot cuttings can often be got to grow in such places, and this offers an important solution to the reclamation of *kallar* areas hitherto considered unculturable. (d) Healthy individuals can be selected at will to form the crop and unhealthy ones rejected. (e) On account of the large amount of food substance stored in the root and shoot cutting the closure of the canal for any reason is less likely to damage or kill it than in the case of the tender germinating seedling, which would certainly succumb to a stoppage of water for even ten days. (f) The water supply required to establish a crop from root and shoot cuttings is found to be about half that required for a seedling crop. (g) The growth of the root and shoot cutting is so very much faster than the seedling that there is little danger of its being killed back or distorted by *kana* grass or other weeds. Sowings have to be kept carefully weeded during the first year. (h) The root and shoot cuttings being spaced at 10 feet by 5 feet they at once experience and become accustomed to a free isolated position not enjoyed by the seedling crops, which are generally crowded together along the berms of the trenches. By virtue of this isolation they enjoy root stability and also a larger volume of ground into which each individual can explore for food. (i) The early thinning of a crop raised from root and shoot cuttings is less urgent than in the case of a crop raised from seed and the omission or delay of this operation will reflect less seriously on the quality of the final yield than in the case of a seedling crop. This is an important point because the labour available in plantations is generally very limited owing to the presence of the colonists in adjoining lands who can afford to pay rates in excess of that which it would be possible to give to forest labour. Plantation management, then, will in future possibly aim at providing the maximum proportion of crops raised from root and shoot cuttings and only sufficient seedling crops to provide an adequate number of root and shoot cuttings for the areas under formation.

Tending.—Apart from weeding during the first year, and keeping the trenches clean during the first three years to facilitate irrigation, it has not been the practice in Changa Manga to touch the young crops till they reach the age of six years. It has been found, however, in Daphar Plantation



CROP OF *SHISHIM* 4 YEARS OLD, RAISED BY SOWING BROADCAST PLOUGHED LAND. PHOTO. TAKEN IN 1925 IMMEDIATELY BEFORE THINNING. DAPHAR, PUNJAB

W. E. Ffrench, photo.



THE SAME CROP TAKEN FROM THE SAME SPOT IMMEDIATELY AFTER THINNING



CROP AT DAPIAR, 4 YEARS OLD, RAISED BY SOWING *SHISHIM* IN STRIPS. THE EXCELLENT SOIL AND ADEQUATE RAINFALL MAKE TH IN THIS PLANTATION. W. E. FLEWETT, 1925



A COMPARTMENT AT CHANGA MANGA SHOWING THE DAMAGE DUE TO THE FUNGUS *FOMES LUCIDUS* AND INADEQUATE SUPPLIES OF WATER, (1925.) PUNJAB

that crops of four and five years of age have had to be thinned, and even at five years the work has to be cautiously carried out, for the stems have already become somewhat whippy. Later thinnings have been carried out at the ages of eleven and sixteen years, but with as short a rotation as twenty years it would appear necessary to thin much more frequently, and experiments on these lines are being carried out. Since mulberry logs of 3 feet in girth—which can be produced in twenty years—fetch up to Rs.4 per cubic foot, when there is much mulberry in the crop the more frequent attention the young trees are given the better will be the quality of the logs produced. After the first thinning, mulberry, if it has not already appeared, can be introduced by under-sowing with great success. This has been done in places in Chincha-watni, where no mulberry has come in naturally.

Irrigation.—The quantity of water which a *shisham* crop requires during the growing season to enable it to put on its normal growth under different conditions of texture of soil, depth of water-level and climate factors, has not yet been established ; but experiments are being carried out to determine this. In Daphar Plantation, with a rainfall of over 20 inches, where the water-level is little over 20 feet from the surface, and where the water-retaining capacity of the soil is considerable, a crop of *shisham* once established can put on excellent growth with but one watering a year, and also a young crop of three years can be completely starved for a growing season without any very detrimental effects. In Khanewal, situated in the arid district of Multan, with a rainfall of but 3 or 4 inches or less in the year, the water-level at 60 feet and a considerable admixture of sand in the soil, two waterings a year given to an established crop is insufficient to keep it alive. An experiment was carried out in Khanewal (where the water supply available is now very deficient) last year to determine the effect of extra watering on *shisham* crops, the growth of which had been restricted through inadequate supply. Separate plots were given two, three, four and five waterings respectively, and the effects of the different quantities of water given are already very conspicuous. The trees to which two waterings have been given are practically dying and in many places the dead stems have been blown down. The plot with three waterings delivered is little better, except that new shoots have been put forth and it is doubtful whether the crop will ever recover to normal growth, but the crops which

received four and five waterings show marked differences in height and girth." The photographs show one or two of these crops. The quantity of water delivered is measured by the depth which would stand on the area if the ground was impermeable. The unit of the discharge of canal water to irrigated ground is the "cusec," or 1 cubic foot per second. One cusec discharge running for one hour will water 1 acre to a depth of 1 inch. The amount of water being delivered can thus be readily ascertained. From experience gained in the Southern Plantation Division it is considered that a total depth of 60 inches must be delivered to a *shisham* crop during the season to enable it to put on normal growth. This incidentally is the depth considered necessary for a crop of rice, and is far higher than that required for cotton. The discharges of channels feeding compartments should be measured daily, and it is essential that the subordinate staff should be trained to take these measurements accurately, and these require to be checked with those of the Canal Officers. Different depths of water can easily be delivered, varying from the minimum required to keep the crops alive to the maximum under which the crops can live, and that quantity of water required by the crop to enable it to put on normal growth can be easily established by experiment. These experiments are now in progress.

A few remarks will be of interest on the three chief plantations referred to above.

Changa Manga.—This plantation is now in its third rotation, the latter being one of twenty years, although the average periods during the first two rotations were fifteen and seventeen years respectively. Various factors appear to have impeded the growth during recent years. It may be considered that a third cropping with the same species would account for the want of uniformity in the growth. This would appear to be contradicted by the fact that agriculturally, at any rate, the soil is more valuable than that outside the plantation. A second factor is insufficiency of water, a point alluded to by Fluett. This may be attributed to several causes, some easily ascertainable, others more difficult to surmise. The short-handedness of the staff during the War years, perhaps, resulted in a slackening of the necessary vigilance in this respect, a factor which would account for the grip the so-called *shisham* fungus (*Fomes lucidus*) has attained over the plantation. One fact is apparent, that parts of the plantation have taken more water than should be the case. This is attributed to the



SHISHAM PLOT 7 YEARS OLD AT KHANEWAL TO WHICH ONLY TWO WATERINGS WERE GIVEN. THE TREES ARE BARELY EXISTING

Photo. by W. E. Flewett, 1925

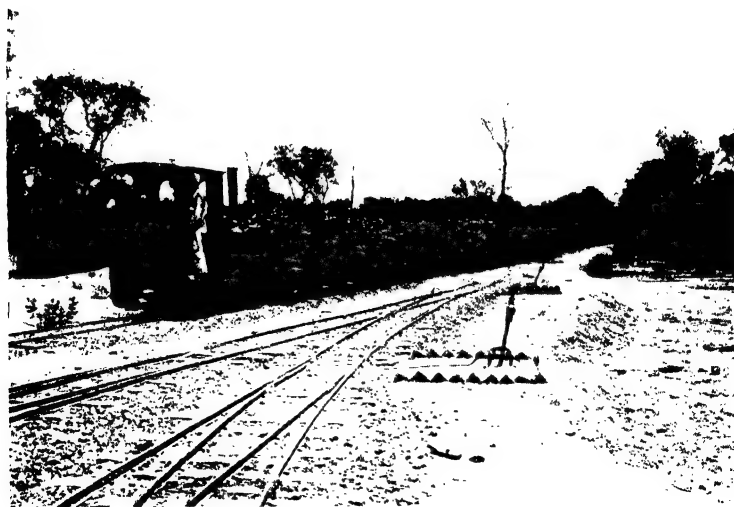


CROP OF SHISHAM AT KHANEWAL. 7 YEARS OLD GIVEN THREE WATERINGS IN 1924. NOTE INCREASE IN LEAF SURFACE COMPARED WITH OTHER



THE LOWER BARI DOAB CANAL AT CHICHAWATNI, PUNJAB

W. E. Fitzgerald, Photo., 1925



STEAM TRAMWAY CARRYING FIREWOOD FROM THE FOREST APPROACHING
 CROSSING BRIDGE AT CHANGA MANGA, PUNJAB, 1925

irregularity in levels at some points, rendering it necessary to flood the low-lying areas deeply to ensure the water reaching the far end of the compartment. Another cause appears to be the growth of the tall *kana* grass and weeds. These check the flow of the irrigation water and consequently absorb more water in flooding a compartment. Lastly, there was a serious drought in 1921. The present state of the crop is undoubtedly attributable to a falling off in the vitality of growth due to these various causes, rendering the trees more subject to the fungus. The dissemination of the pest may have been assisted by the irrigation water. It appears possible, after visiting the plantation, that had the officer in charge had the advantage of the expert advice of a Mycologist several years ago the ravages of the fungus might have been stopped in time. This fungus, and it is thought that there is a second species present, was thought to be both parasitic and saprophytic on both the *shisham* and the mulberry. It appears to have been first reported as a dangerous parasite on the *shisham* some thirty years ago. The fungus was recorded at Chagna Manga in 1907, and may have started in compartments which were receiving an insufficiency of water. It is noteworthy that some of these at present only contain a few very poor standards, the rest of the area having reverted to the original *rakh* conditions. In a number of compartments, Fluett states, "the crops are now practically pure mulberry, and the *shisham* standards, by now few and far between, are mostly fungus attacked." In discussing the attack on the mulberry, he writes: "The mulberry has also been the subject of very serious fungal damage, to which attention has only recently been drawn by Mr. B. O. Coventry (the Conservator). The fungus appears to have originated in old stools from which it spreads to the coppice shoots and kills them, the whole clump eventually toppling over." Coventry had visited the plantation in March, 1925, and in June reported the attack of the fungus on the mulberry, and suggested that the *taungya* method of regeneration should be employed to remedy the position owing to the advantages in removal of infected stumps, aeration of the soil by ploughing, the additional labour force which would be available, the dearth of labour in the plantation having been chronic, and so forth. Before passing orders the Chief Conservator requested Parker, the Forest Botanist, to visit the plantation. Parker had formerly been in charge of Changa Manga and wrote the Working Plan of 1917. In this latter he had drawn attention

to the presence of the fungus on the *shisham* in some of the compartments and the damage being done, and appears then to have envisaged the possibility of having to give up the growth of *shisham* owing to this cause. He gives in the Plan a comprehensive list of all the species experimented with or which had come in naturally into the plantation, Parker's visit took place in October, 1925, and his report upsets the idea as to the fungus attack on the mulberry. He states categorically that the plantation was suffering from the effects of the drought of four years ago, and also, perhaps, from careless supervision of the watering. "I saw," he says, "no evidence whatever of parasitic fungi on any species but *shisham*. With the exception of one or two compartments the whole plantation now has the aspect in 1915 of the four compartments which, about 1910, for some four or five years were watered in alternate years. The mulberry particularly has suffered, and this is to be expected as this species is more sensitive to drought than any other trees in the plantation. In many places mulberry has been more or less completely wiped out, and where the crop was originally pure mulberry there is now often nothing left." Parker then instances certain compartments as proof that drought is responsible for the present condition. As regards the fungus growth on the mulberry, he writes: "Sporophores are not uncommon on living mulberry trees and these are almost always coppice shoots. The sporophores occur near the base of the stems and strongly suggest that the old stump is the seat of the infection. Rot from the old stumps can easily spread into the heartwood of the coppice shoots and lead to the fall of the resulting trees. These fungi are not parasitic and do not damage the living portions of the tree directly." He adds: "Evidence is being accumulated to show that even on *shisham* *Fomes lucidus* is not a true parasite, and that it follows an attack by a fusarium. If this is really the case it explains a great deal, since nowhere except in India and on *shisham* is *F. lucidus* looked upon as being a parasite." There the matter stands at the present. It cannot be termed a satisfactory position so far as Research and the Research Institute, or the Divisional Forest Officer, are concerned. Parker's report only confirms the urgent necessity for a Mycologist.

New species are to be tried in the plantation. The raising of young *Eucalyptus* in the nursery is now being experimented with. There are some magnificent specimens in the compound of the Changa Manga bungalow, some dating from the origin

of the plantation, so the possibilities of success by this means appear to be promising. *Bakain* (*Melia Azederach*) is obtaining a market, fetching Rs.2 per cubic foot. It is used for furniture and, it is said, the demand would be greater if there were more of it in the plantation. A considerable amount of artificial restocking has now become necessary.

The Chinchawatni Plantation.—This plantation and that of Khanewal are in the Southern Plantation Division, which comprises 30,000 acres. Four thousand acres of Chinchawatni have been planted (April, 1925). The work has proceeded steadily since 1913-14. The chief difficulty experienced here is the salt in the ground, in some parts resulting in a very poor soil. The plantations were started by sowing *shisham* seed. This failed on all the poorer areas containing much salt. These areas are now being successfully restocked by means of *shisham* root and shoot cuttings. The process of formation of the new plantation areas is undergoing a change owing to the discovery of the *shisham* root and shoot cutting method, as already explained above. This plantation, which is situated on the Lower Bari Canal, may be termed a great success. The water supply is sufficient, though some of the troubles of Changa Manga are present, notably the high *kana* grass. The Divisional Officer now makes the Forest Guards responsible for stubbing out the young grass roots when they first appear in the young plantations, fining the Guards if grass masses are found in such areas. The first compartment will come up for felling in eight years from 1925. Thinnings have been undertaken. In a nine-year-old plantation they yielded about 8 annas per 100 cubic feet, with an average of 320 cubic feet per acre. In older coupes 12 annas 6 pies are obtained per 100 cubic feet. The tramway, which is to be laid down in this plantation, being absent and the labour market distant, higher prices are not yet realizable for this small material. When the crops become mature the thinnings will doubtless realize good prices and the plantation should become a very valuable one. It may be mentioned that some of the thinning work carried out here is excellent and reflects great credit on S. Bahadur Singh and on his Deputy Ranger, Fakil Chand. The importance of timely and correct thinning in crops of this nature cannot be too strongly insisted upon since the ultimate revenue realizable is greatly dependent upon the operation. To delay necessary thinnings owing to the material being unsaleable would be a very shortsighted policy.

The Khanewal Plantation.—As has been indicated by Fluett, troubles are being experienced in this plantation owing to deficiencies in the water supply to the outermost parts of the area, where the planting was commenced. This has had a serious effect on the growth in some compartments, as the photographs depict. The oldest crops were eight years old in 1925, some 9514 acres having been planted up to April of that year. The rate of planting is as follows: 1916-17, 808 acres; 1917-18, 673 acres; 1918-19, 944 acres; 1919-20, 733 acres; 1921-2, 2515 acres; 1922-3, 2682 acres; 1923-4, 479 acres; and 1924-5, 680 acres. The area has been chiefly sown. The deficiency of water may to some extent be attributable to the fact that the water had to come right across the tract to reach the first plantations, the rest of the area being let for temporary cultivation and thus heavily indenting on the available water supply, little assistance being obtainable from rainfall which is negligible in this part of the Punjab. Fluett has alluded to the poor growth of some of these plantations and to the experiments now being undertaken with a different number of waterings. S. Bahadur Singh suggests replacing the *shisham* with *farash* (*Tamarix articulata*) in compartments where the water supply appeared to be permanently deficient. He states that the rotation for this species would be ten years, so two crops would be obtainable from an area in lieu of one of *shisham*, and the revenue return would be approximately the same (Rs.18 per acre for *shisham* and Rs.10 for *farash*).

In view of the important part these plantations must play in the future of the Province, it would seem that this question of the amount of water essential to their maintenance in any particular district should be definitely ascertained and fixed with the full authority of the Government behind the decision. This would remove all cause of friction between the Canal and Forest Authority on the one hand, and between the latter and the cultivators on the other. The plantations are as necessary to the well-being of the people as the crops, whilst at the same time producing a direct revenue to the Government. It appears a short-sighted policy to stultify the work of the Forest Department, whilst at the same time jeopardizing a source of revenue owing to a failure to supply the necessary amount of water to areas of plantation already in being. A statesmanlike canalization policy should envisage the area deemed essential for the supply of timber and fuel as a



SHISHAM CROP 10 YEARS OLD, CHICHAWATNI PLANTATION. ONE YEAR AFTER THINNING. PHOTO TAKEN DURING
AUTHOR'S VISIT IN APRIL 1925, PUNJAB

W. E. Flavett, photo



SHISHAM CROP 10 YEARS OLD UNDERSOWN WITH MULBERRY. CHICHAUATNI. THE MULBERRY WAS SOWN IN 1924
Photograph 1935 by H. E. Flegitt, I.F.S.

necessary concomitant of the whole scheme. Even should the population eventually take to burning coal or oil, the value of the plantations will not diminish, as forest industries will arise which would easily absorb all their products and increase the sources of wealth of the Province.

That the Government are now fully alive to the water problem is evidenced from the following remark in the Proceedings of the Government of the Punjab, No. 851 (Forests), dated 13th January, 1925, on the Annual Forest Report, 1923-4, and the Quinquennial Summary, 1919-20 to 1923-4: "The necessity of an adequate supply of water for irrigated plantations has again been emphasized by the disastrous results in the Changa Manga Plantation of the shortage in 1920-1. The Department is conducting a very encouraging experiment in restocking areas with root and shoot *shisham* cuttings with a view to reducing the quantity of water required during early growth, and the Irrigation Department is cooperating in the matter of the expeditious supply of water to the full capacity of the distributaries. Government hopes that a satisfactory solution of the problem will soon be found."

A point in connection with these plantations which struck the author during his visit was the extreme necessity and urgency of carrying out some experiments on the subject of the necessary thinnings. In areas originating from seed the crops come up dense, and early cleanings and a thinning appear imperative, even should the material be unsaleable. With so short a rotation as twenty years, and it is not impossible that it might be financially sound to reduce the period, early thinnings would probably ultimately increase the yield. A Sylviculturist could solve this problem in a few years. It may be suggested that to apply the Changa Manga rotation and methods without further efforts at improvement may not prove to the best interests of these valuable new plantations.

Up to the end of 1923-4 the total expenditure incurred on the four plantations—Tera, Chinchawatni, Khanewal and Daphar—amounted to Rs.6,27,157 and the total revenue derived from them Rs.18,57,379. This revenue was mainly derived from temporary cultivation on the unplanted parts of the areas.

The above account of the fine work being carried out in the Punjab will, it is hoped, be sufficient to demonstrate the very

great importance, under certain conditions, of the Irrigated Plantation and exhibits some of the difficulties in its formation and management ; difficulties, it may be added, which require to be understood by the Government, its officers, the various Departments of Administration and the people if success, both economic and financial, is to be achieved.

THE RAVINE AFFORESTATION WORK IN THE UNITED PROVINCES

The second instance of remarkable afforestation work being carried out in India is the reclamation of the waste ravine tracts along the Jumna and Chambal Rivers in the Etawah, Agra, Jalaun and neighbouring districts of the United Provinces. It will be remembered that Webber alluded to these areas during his visit in 1866, describing the appalling heat of " these miles of ravines all sloping towards the river bed, eaten out by the rains " (II, p. 298). Much of this country was once fertile, its present condition being due to ignorant disafforestation in past times at the head waters of the Jumna and its seventeen tributaries, of which five rise in the Himalaya, three in the Siwaliks, where, as this history has shown, the forests were more or less devastated, three in the Vindhya Hills, one in the Satpuras and five in the plains of the Doab. At the present day the forest areas on many of these rivers are altogether inadequate to prevent further denudation by sudden flooding, and so forth, and are often far too heavily grazed. So far as the Jumna is concerned the accumulated effect of this flooding and scouring has resulted in its bed at Etawah being lowered 60 feet in the last 500 years. Mr. E. Benskin, Deputy Conservator of Forests, in *East and West* (September, 1918) gives the following remarkable description of the area to be considered here : " The cold-weather level of the river (Jumna) in the Etawah and Jalaun districts is often 120 feet to 200 feet below the general level of the surrounding country. The sinking of the bed of the river is draining the country, and the well water-levels are sometimes as low as 200 feet. The banks of the Jumna in the Agra, Etawah and Jalaun districts are now so completely drained that they have become almost destitute of vegetation, except a desert flora, and even this is disappearing. This dry belt is increasing at the rate of 250 acres each year in the Etawah district alone. The absence of protective vegetation on the banks and the flow of water from

the high plateau to the river has caused a complicated network of ravines to be formed. These ravines often start suddenly at the edge of cultivation with a drop of some 80 feet, or they may be less severe, and take up a meandering course joining up with other systems, eventually falling into the river. The actual area of these ravines in the Etawah District alone is 120,000 acres, and the area of similar land in the Provinces is some millions of acres. The land is at present almost valueless to the owners, as it yields grazing of the very poorest description. Cultivation beyond this desert belt is precarious, even in years of normal rainfall, and drinking water often becomes so rare as to necessitate the migration of whole villages, and throughout the whole expanse of the ravines there is no water to be found, excepting the main rivers. A study of the soil will show that it is very fertile, but it is too cut up and arid for cultivation. The monsoon rains only sink to a depth of a few inches, and below this the soil is quite dry till the spring level is struck. It would appear that the present tree growth is of very great age, which has continued to reproduce itself by coppice shoots, and the root system has kept pace with the sinking spring level: natural reproduction invariably dies down as soon as the rains cease. The drying up of the country is a most serious matter which may be temporarily relieved by the expenditure of lakhs of rupees on irrigation, but if the erosion of the country continues at the present rate, irrigation projects will be hampered and may eventually become impossible. The Etawah District was once covered with sâl forests and many villages are named after the tree: Sakhi, Sakrauli-Sakhua, Sakhopur, and it is recorded that the Emperor Babar hunted in these forests. The sâl tree requires a moist climate, but the conditions have so changed that there is not a single tree between the Himalayan Terai and the Satpuras. The drop in the Jumna level is established by the prevalence of old sugar mills in the Etawah trans-Jumna area, where the water-level is now far too low to admit of irrigation, and also in the fort at Shergadh near Aaraya, the curb of the large well in use in 1550 is now sixty feet above mean flood level."

The administration in India has always been more progressive in dealing with the utilization of waste lands than has been the case at Home. There are several millions of acres of practically unproductive land in Britain for which no far-sighted reclamation scheme has ever been evolved by practical

men. In the case under consideration in India the problem of utilizing the waste lands in the several districts as fuel and fodder reserves was under consideration in the time of Brandis, and he drew up a Report recommending, as an encouragement to forest growth : (1) fire protection, (2) restriction of grazing, (3) protection from all wood cutting, (4) filling up of blanks by planting and sowing. An enquiry was subsequently undertaken as to the extent of the areas of waste land in the Province which could be utilized as fuel and fodder reserves. The areas proved so extensive, the probable expense so costly, and the professional knowledge and staff then available so inadequate that Government deferred action. In 1882, however, Mr. T. E. Fisher, Collector of Etawah, who should go down to history as a second Conolly (of Nilambur Teak Plantation fame), assembled some of the zemindars who owned the tracts of ravine land to the west of the town of Etawah and suggested their attempted afforestation. The proprietors agreed to hand over their land in order that efforts might be made to prevent further erosion and deterioration. The proprietors were to provide the necessary funds, and in return the profits were to be divided *pro rata* according to the money furnished and the land held in each case. The management of the Reserve was entrusted to the Collector, who started the new work the same year. Grazing was prohibited, the soil broken up with the country plough and the seed of *babul* (*Acacia arabica*), *shisham* and *neem* or *nim* (*Melia indica*) sown. *Bandhs* (embankments) were erected across the ravines in suitable places in order to dam up the rain water and raise the spring level. Detailed records of the work do not seem to have been kept unfortunately, or have been lost, but it appears that the small expenditure incurred was more than recouped by the sale of grass, and subsequently from grazing dues and light fellings. The scheme worked well for a time, and a fairly good crop of *babul* was eventually obtained of sufficient value to induce a firm to take over the forest on a fifty-years' lease with the object of extracting tan bark, the payment made being approximately Rs.2 per acre and an annual rental of Rs.1 per acre—a rather short-sighted policy to adopt in the case of so promising an experiment, since the Fisher Forest was to some extent ruined thereby.

The next step was taken under the auspices of Sir John Hewett, when Lieutenant-Governor of the Provinces. In 1912 his Government defined a policy with regard to the reafforestation

of denuded areas and the establishment of fuel and fodder reserves. One of the first attempts was made at the Allenbagh, near Cawnpore. In 1914 Government acquired 128 acres and afforested it with *shisham*, *babul* and *Gmelina arborea*. The Messrs. Allen of Cawnpore at the same time constructed a *bandh* across a ravine, forming a lake of some 50 acres. In 1917 they, with a true public spirit, purchased another 124 acres and presented it to Government provided it was afforested. There are thus 202 acres of forest. Meanwhile a preliminary survey of existing waste lands was made, and a Report issued recommending, in the first instance, the reclamation and utilization of ravines along the Jumna and Chambal Rivers in the Etawah district. This time there was no set-back, and to Hewett's far-sighted statesmanship the Province owes one of the most remarkable afforestation schemes that perhaps any Government has ever put in hand. The owners of the land in the areas it was proposed to deal with were consulted by Mr. H. R. Meville, Collector of the district, and a scheme, somewhat on the lines inaugurated previously by Fisher, was agreed upon, except that in this case the Government undertook to defray the costs of the afforestation work and to recover the expenditure out of the profits, eventually handing back the lands when the debt had been cleared ; an arrangement which, in the light of the previous history of privately owned forests in the country, and considering that the land had practically no value, was the weak clause in the agreement. However, by 1918 some 24,000 acres of land had been taken over for reclamation under this agreement.

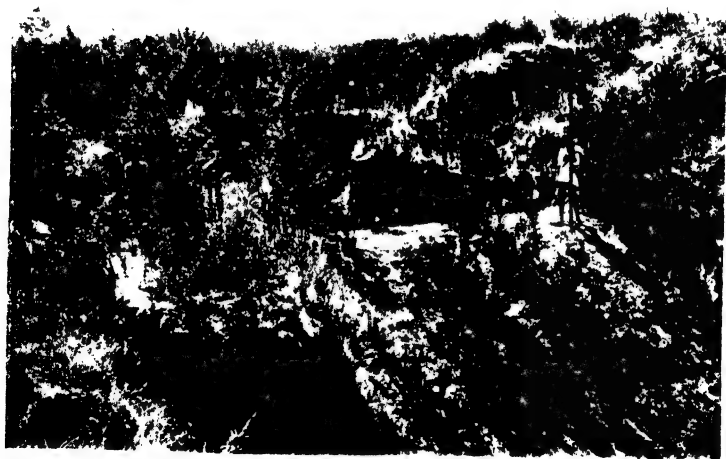
The afforestation work was commenced by the Department in 1913-14, Mr. A. E. Courthorpe, Deputy Conservator, being appointed in charge. The areas undertaken were in the Fisher Forest and Kalpi ; they were of small size and the work, which owing to the excessive heat was extremely trying, was of an experimental nature for the first few years. Once again it was proved beyond doubt that success was attainable though the experiments broke down the health of their originator. Not only was it proved that these lands would become valuable as fuel and fodder reserves, but it was considered probable that they could be made to produce small timber. That the plantations, if raised, would be of considerable economic importance was obvious owing to the high price and scarcity of building timber in these districts and to the ever increasing demand for firewood, whilst the demand for tan materials in 1918 was

regarded as almost unlimited. The Department saw its way clear to the markets and put unbounded energy and resource, combined with infinite patience and professional knowledge, into the work. That it had its reward will be abundantly evidenced by the amazing results attained (which are strikingly displayed in the Plates), though these results require to be seen on the ground in order that the magnitude of the achievement may be fully assimilated. The necessity of undertaking considerable preliminary cultural operations, such as ploughing and embanking, is due to the soil of the ravines being of an alluvial type, of a fine texture which, on drying, solidifies to the consistency of rock. The re-establishment of sufficiently favourable conditions for vegetation is thus a first object. This can only be done by breaking up the compact surface soil and so improving the soil aeration and moisture content. It was considered that once a forest was established the roots would penetrate in all directions into the subsoil and would break it up sufficiently to allow of aeration and moisture soakage. The shade of the trees would prevent excessive consolidation, the litter and grass growth would retard the rain wastage and the water which escaped could be caught in small ponds held up by the *bandhs* erected across the ravines, or by blind ditches and embankments on the higher ground. Grazing was also to be strictly prohibited. These expectations have been fulfilled. For breaking up the ground Beskin considered that no better instrument could be found than the *sabul* plough, which is drawn by a pair of the fine big Northern Indian oxen. The roughness of the ground, however, necessitates a great deal of the work being done by hand. In Etawah where irrigation is not possible, in contrast to the fine irrigated Punjab plantations, the plantations depend solely upon intense initial cultivation. Owing to the difference in formation and maintenance between the two types of plantation, it is considered by some that the non-irrigated type will be less liable to insect and fungoid attacks.

On the first year's experimental work Beskin wrote (in 1918) as follows : " The first noticeable effect of breaking up the soil and conserving the water is the disappearance of the original worthless grasses and their replacement by those of good feeding value. The water wastage is further checked by the heavy grass growth and the beds of the *nullahs* become covered with turf. Sowings of various forest trees have been made on the freshly broken-up lands and it is found that many valuable



RAVINE RECLAMATION. HEAD OF A RAVINE BEFORE TREATMENT, SHOWING EROSION. ETAWAH. AFFORESTATION DIVISION, U.P. 1918



RAVINE RECLAMATION. HEAD OF A RAVINE 2 YEARS AFTER TREATMENT SHOWING GOOD GROWTH OF *SHISHAM*, *BABUL* AND GRASS. EROSION COMPLETELY CHECKED. KACHERI BLOCK, ETAWAH, AFFORESTATION DIVISION, U.P. 1918



SHISHAM (*DALBERGIA SISSOO*) PLANTATION, 4 YEARS OLD ETAWAH, AFFORESTATION DIVISION, UNITED PROVINCES.
MAY 1925

species can be raised, among which may be mentioned teak, *shisham*, *kambhar* (*Gmelina arborea*) and *babul*. The success of these sowings during the last two years has been very satisfactory, and in many places the growth is so dense that it is almost impossible to walk through it. Many of the trees sown in 1915 are more than 20 feet in height and are already fit for fuel. An examination of the conditions after these operations shows that the moisture penetration has very materially improved; and that erosion has been effectively arrested. It is, however, essential that a broad protective belt of land at the head of the ravines should be afforested to prevent further encroachment inland. Some portions of the areas less liable to erosion will be reclaimed as grazing grounds and will be maintained by periodic cultivation. The improvement of village grazing grounds throughout the Province by working them on an interchangeable rotation is a matter which deserves the attention of the country so as to relieve the forests of grazing. Up to March, 1917, 1325 acres of ravines had been reclaimed and afforested at a cost of Rs.78,368 or approximately Rs.60 per acre, inclusive of all charges. There is every indication that the cost can be considerably reduced and that the ravines can be profitably utilized for fuel and fodder reserves. The plantations require very great attention and care during the first few years, as they are subject to the attacks of all kinds of enemies."

On this subject Mr. McDonald (in a note to be referred to later) writes as follows—the similarity to the troubles experienced in British woods is remarkable: "The chief damage from animals has been from porcupines, whole compartments of a year's work have been totally destroyed, and I have not yet been able to discover a species of tree they will not attack. They do not go for plants over 10 inches in girth, but anything below is nothing to their teeth. A certain amount of damage has been done by browsing animals such as blue bull and deer, and pig have sometimes dug up ridges when the seed is first sown. Partridge and peafowl are very fond of going along a ridge, when germination starts, and pecking off the cotyledons. Generally speaking the chief damage is by porcupine, and steps are being taken to keep them down; it is gratifying to note that we account for about 1000 every year. Frost has caused serious damage in the past, but this is being minimized by not planting frost-tender species in frosty localities."

Beskin pointed out that this plantation work could be

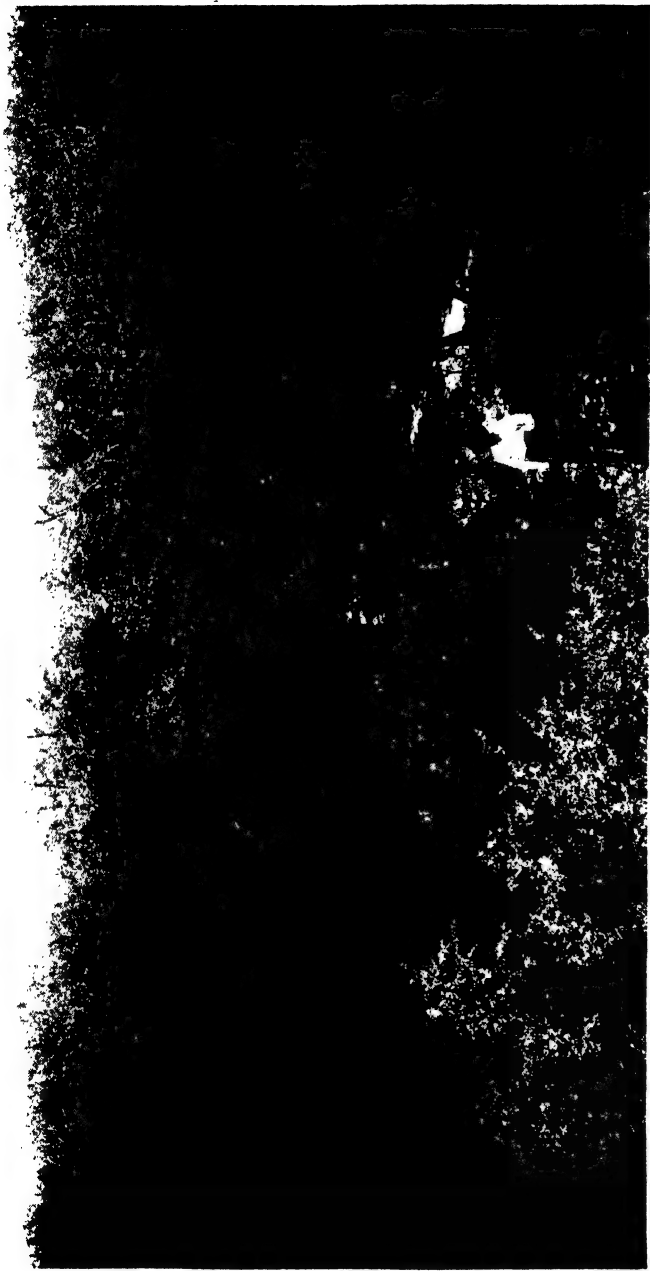
utilized as famine relief work, and that this form of relief work had the advantage that it could be closed down at any time without leaving it incomplete, and would yield an ultimate financial return. Government agreed to this view, and during the great famine of 1918-19 the first serious attempt at dealing with a large area was undertaken, when 900 acres were afforested, including work on old areas which had failed. From 1919-20 the annual area taken in hand was increased, till by 1925 from 2300 to 2500 acres were being annually afforested, spread over the following nine districts mentioned in order of importance, viz. : Etawah, Jalaun, Agra, Jhansi, Cawnpore, Lucknow, Aligarh, Unao and Meerut ; the total area being 43,000 acres. In 1918-19 all the famine works in areas where the Department had Forest Blocks were managed by its officers. Soil preparation, embanking and digging up the soil in old plantations were the three main forms of the work on which famine labour was employed. About 200 *bandhs* (ridges) were constructed at this time. The Government expressed their high appreciation of the skill shown by the officers of the Department in their management of these relief works, and the areas afforested as a result have proved very successful.

In 1923 the results attained were summarized as follows : " Erosion of the soil is completely checked within two years and the monsoon rains sink into the soil instead of scouring it away. An excellent crop of good fodder grasses is obtained. From 8 to 10 maunds of grass are obtained per acre of plantation, affording a provision during severe fodder famines which occur more frequently in these Jumna ravine tracts than elsewhere in the Province. The importance of such a supply is incalculable since, owing to the broken nature of the country, the import of fodder from other districts is almost impossible and prohibitively expensive. The rate of growth of *babul* and *shisham* is remarkable ; on the dry plateaux and slopes the growth is fair, but in the moist fertile ravine bottoms and on *bandhs* the rate of growth is the finest in the Province. *Shisham* trees have been obtained 50 feet high in seven years and *babul* has grown over 20 feet in four years. Other important tree species also show great promise, and bamboos grow well. Up to date over 10,000 acres of ravine lands have been successfully completed."

The methods of acquiring the land for the work had undergone some modifications. Mr. M. J. McDonald, the present Divisional Officer, drew up a note for the author in which he



RAVINE RECLAMATION BY FAMINE LABOUR, ETAWAH. CONSTRUCTION OF A RUND, MAY 1919.



RAVINE RECLAMATION, ETAWAH. THE SAME SCENE AND THE SAME VIEW, 4 YEARS LATER. AUGUST 1923 v-

describes the methods in the following terms : " Only in a few cases have we selected areas for afforestation, i.e. Agra and Cawnpore ; for the rest the land has been made over to us. We now hold land as under : (1) Land acquired. (2) Nazul land made over to us. (3) Leased land. (4) Land made over to us by other Departments who had acquired it. (5) Land made over to us by zemindars for afforestation. The afforestation is done by Government ; expenses and profits will be shared, 75 per cent to Government and 25 per cent to the zemindars, and until we make profits we pay the zemindar 8 annas per acre per annum on the treated area, this payment ceasing in the year when profits are shared. (6) Land managed by us for owners, they paying all expenses. (7) Land where the owner does the work and we advise. Before we take up an area offered to us the soil is examined, and a report as to markets, etc., drawn up, the rainfall being an important factor in our consideration." Under (5) the Department holds about 24,000 acres, of which about 8000 acres have been afforested. The whole Afforestation Division amounts to about 56,000 acres. The major part of this area (outside the 24,000 under (5)) is Government property, either acquired or leased on a fifty-year period (nominally $2\frac{1}{2}$ rotations of twenty years). It also includes some tracts of natural forest situated in the Jhansi Division, but which are more easily managed by the Afforestation Officer.

McDonald explains the present-day practice of formation, which is the outcome of careful experimental work, and deductions therefrom in the following : " In level areas the soil is broken up first with ploughs, and then ridges 2 feet by 1 foot in section and 10 feet apart are run along the contours, seed being sown on top of the ridges. In sloping country where ploughing is not possible ridges are constructed by piling up the earth dug from a trench 2 feet wide by 1 foot deep, the ridge being made below the trench. In both operations great care is taken to prepare the foundation of the ridge properly, the soil being dug up to a depth of from 6 inches to 9 inches. The first method is cheaper than the second (and the grass crop is better), the cost on an average being respectively Rs.10 and Rs.14. All sowings are done before the rains break, i.e. are finished before 15th June. Seed is sown in a furrow about 1 inch deep along the top of the ridges and the furrows closed ; where possible seed is removed from pods before sowing. Planting of (a) bamboos

(one-year-old plants), (b) *Dalbergia Sissoo* (root and shoot cuttings from one to two-year-old plants), (c) *Albizzia Lebbek* (sown in a similar fashion to *shisham*), (d) *Butea frondosa* (roots from old plants and seedlings), is done after we have had enough rain to properly damp the soil, a cloudy day being selected for the work. Planting is either done in pits filled in or on ridges. The species giving the best results out of some 200 experimented with are *Acacia arabica*, *Acacia Catechu*, *Dalbergia Sissoo*, *Albizzia Lebbek* and *procera*, *Butea frondosa* and bamboo. Those giving fair results are *Gmelina arborea* and *Hardwickia binata*." On an average seedlings reach from 2 feet to 4 feet in the first rains and by the end of the second rains are from 3 feet to 6 feet in height. In the sown areas weedings and cleanings start early, by the end of the first rains the seedlings being left 1 foot apart. At the end of the third monsoon the distance between the plants is roughly 4 feet. A third thinning is carried out in the eighth year, when the distance between the trees is from 6 feet to 7 feet. A fourth and final thinning is laid down to be carried out in the fifteenth year. McDonald estimates that the distance between the trees after this thinning will be about 15 feet to 20 feet. The construction of *bandhs* across the side ravines in order to hold up the flow-off from the land, thereby silting up the ravine, has been discontinued as it added Rs.6 per acre to the total cost of preparation and its usefulness is doubtful. As regards marketing the produce, although the material other than grass has been small, no difficulty has been experienced in its disposal. The available grass has fetched on an average about 4 annas per maund net (Rs.1.8 per acre on the treated area to 1925), the fuel from 4 annas to 6 annas per maund, and bamboos Rs.10 per 100. The revenue in 1919-20 amounted to Rs.4000 and that of 1924-5 to Rs.31,000, an increase of Rs.27,000 in six years.

In the Allenbagh the *shisham* from the 1914 sowings was 45 feet high in 1925 and that from the 1917 sowings 35 feet. McDonald writes : "Annually we get back about Rs.4000 from this block, or Rs.20 per acre of afforested land. This is from light thinnings, grass and collection of twigs. What we are likely to get when we fell is difficult to say. There was a scheme to extend, but I fear it will have to be dropped as we cannot get adjoining land below Rs.350 per acre now."

An interesting possibility in these plantations is that revenue may be derivable from a minor product, lac. On

this subject McDonald writes : " The cultivation of lac may be mentioned. An experiment was started on *khair* (*Acacia Catechu*), *dhák* (*Butea frondosa*) and *Zizyphus Jujuba* with lac a year and a half ago. The first year was marked by a very severe summer when most of the *Jujuba* lac died, all of the *khair* and a little of the *dhák*. However, the experiment, notwithstanding unfavourable conditions, in my opinion is a great success. We have spent up to date about Rs.550 (Rs.480 being for the original supply of brood lac) and have so far recovered Rs.350, and in addition I have about 300 trees covered with very promising lac, which should yield about Rs.400 to Rs.500 this November (1925). I am of opinion that *dhák* is the most promising species to make use of in this Division, and it is a pity that this species has not been more cultivated in the past, as not only is it a very good host for lac, but it makes an excellent fuel, and the roots produce a very superior fibre used for making large fishing nets and caulking boats."

It will be of interest to glance briefly at a few of the more striking results already attained with the various species in use, as expressed by McDonald in his note and to the writer whilst visiting the area in May, 1925.

Acacia arabica.—This species was planted pure in the older plantations, probably owing to its market value. The seed germinates readily and the seedling grows fast. It coppices well whilst young, so can be worked on a rotation of twenty years. McDonald is averse to forming pure plantations of the species owing to the fact that (1) a night's frost will kill trees 20 feet in height, so it should not be planted in hollows ; (2) it has a deep root system. In all the ravine areas *kankar* (lime nodules) is found at 6 feet to 10 feet ; the tree thus starts well, but as soon as its roots reach the *kankar* growth ceases and the tree begins to die. Numerous examples are to be seen in the Division, and the Divisional Officer fears that the older plantations will suffer from this cause.

Dalbergia Sissoo.—In 1925 about 30 per cent of every compartment contained this species. " It does equally well," says McDonald, " from seed or root and shoot cuttings, but when using the latter it is important that (a) plants thinner than one's thumb should never be taken, (b) 6 inches of root and 1 inch of stem should be used, (c) at first about six shoots will appear on the cutting, all except one should be broken

off, and when this shoot is about 6 inches long the part of the original cutting above ground should be covered with soil. If this is done carefully cuttings should produce a shoot 4 feet to 5 feet high in the first rains. *Sissoo* does not mind frost and can stand being under water for a time, and there is an unlimited demand for the timber."

"*Acacia Catechu*.—This species was first tried in 1920. Since then about 400 acres are being sown annually. It shows very little growth in the first year, but shoots up rapidly in the second and third, reaching a height of 12 feet in the fourth rains. It does not mind a bad soil and is useful for stocking inaccessible blocks. The product *katha* (cutch) is obtained from it, for which there is a great demand; this sells at about Rs.200 per maund and costs about Rs.40 per maund to produce. An indigenous species of this tree grows in the ravines, but never reaches more than 15 feet in height, whilst seedlings from sub-montane seed reach this height in six years."

Albizia Lebbek and *procera*.—These species were first sown in 1920 and gave good results. *A. Lebbek* is now being grown extensively both from seed and root and shoot cuttings. It is shallow rooted, does not mind the *kankar* and stands frost and hot winds well. It yields a better timber than *A. procera*.

Gmelina arborea.—Has given fair results, but cannot stand hot winds, trees 10 feet high having been killed to the ground in the hot weather. It grows rapidly both from seed and root and shoot cuttings, and does well in sheltered hollows.

Butea frondosa.—McDonald's opinion on this species has already been quoted. He considers it one of the most valuable. "It does well from both seed and root and shoot cuttings. It coppices very profusely and can be worked on an eight-year rotation (private owners work it on a three-year rotation); in fact once the roots have secured a hold it is almost impossible to kill out. This species will come up on any sort of soil and does not mind frost or drought, and in the younger stages does not appear to require weeding. It may die back for one or two years, but once its roots are established growth is very rapid." In addition to fuel, fibre and lac the leaves find a sale for packing Indian sweets, and in the Central Provinces are used as wrappers for *berees* (a kind of cigarette) and the flowers yield a dye.

Bamboos.—These were first tried in the nursery in 1916, but the work of putting them out on a large scale only dates

from 1924. The seedlings are raised in the nursery and planted out when one year old. The results are so far good, if the promise is maintained they will prove an asset, as returns are quick and there is a great demand for bamboos of all kinds.

A few reflections inevitably occur to the Forester after studying the striking results which have already been attained in this afforestation work. The ravine country roughly stretches on both banks of the Jumna and Ganges, the Betwa and other large tributaries of the two great rivers from Allahabad to Delhi. Its width is from about 1 mile to 6 miles from the banks of the rivers. In the purely ravine areas there is no cultivation. Occasionally in the alluvial soil on the banks of the rivers small areas of crops are to be found. Otherwise there are several million acres of what is perhaps best expressed as a torrid howling wilderness which in the hot-weather months, when the west wind, termed the "loo," sweeps across it with unprecedented violence, is inimical to most animate beings. The afforestation work in the areas so far attempted has brought about an almost unbelievable change in the conditions. Forests, low in stature at present, and the height growth will vary with the depth at which the *kankar* is met with, now clothe these tracts and even in May, in the height of the hot-weather season, it is possible to visit these areas in the morning or late afternoon without great discomfort. Not only will it be possible to cover this wilderness of deep ravines with forest, but the work should greatly benefit the country-side and result in a rise in the spring level of the water, when a sufficient area to make its beneficial influence felt has been afforested. It does not appear to be a too sanguine prediction to affirm that if the Government of the Provinces carry through this reclamation work they will have undertaken one of the most amazing examples of afforestation the world has seen. The only comparable instance with which the author is acquainted is the afforestation of the Landes in Gascony. This has remained the classic example for a century, but the Ravine Afforestation work bids fair to outvie it.

The various methods by which the land is being obtained for the purpose should prove of interest to other countries which have tracts of waste land in private ownership. The Divisional Officer informed the author that there would be no difficulty in obtaining more land from the zemindars on the 8 annas annual rental with the profit-sharing basis.

That the value of the work has become fully appreciated by the Indian proprietors is evidenced by the fact that the wealthier amongst them have in the past come to the Divisional Officer and asked him to afforest their land, they paying the cost. McDonald said that in several instances the first intimation he had received of such a request being proffered was the proprietor appearing in person "with a great wad of notes and asking him to undertake the work." Should the suggestion be agreed to, the Divisional Officer first has the area marked off and then places the work under the supervision of one of his Rangers, and appoints a new Forest Guard, sending him to a place where he can be trained, meanwhile appointing one of his trained Guards in temporary charge. Accounts are sent to the zemindar each month, the latter paying part of the Ranger's pay, that of all the subordinate staff employed on his area and the travelling expenses of the Divisional Officer (but not any part of his salary) when he visits the area. The sanction of the Government has to be previously obtained in each case. Some 7000 acres have been afforested in this fashion up to 1925.

A reflection which perhaps not unnaturally occurs, with so general a recognition of the enormous potential value of this great work, is whether it would not be advantageous to push it on with greater celerity and undertake annually a far larger area than the present 2300 to 2500 acres. A second and more important question for the consideration of the Government is whether it would not be advisable for the State to secure the ownership of a far larger proportion of the land in order to assure that it shall remain afforested and be correctly managed as a permanent forest area. Private ownership of forest tracts in India, once they have a marketable value, as this history has well exhibited, is no safeguard for the future. And the same may be said for many other parts of the world. Fifty years in forestry, even when dealing with short-rotation crops, is an all too fleeting period. And in the case of privately afforested land a successor at will may within a short space destroy the work of years. Owing to its broken nature the land will be useless for agriculture for a long period. The afforestation work so far undertaken has shown that the work is in the best interests of the community and of the Province. As it proceeds it may hope to arrest further denudation and the loss of valuable agricultural lands, objects which are achieved by France in the Landes ;

it should benefit the local climate and raise the spring level of the water ; and finally, it will supply an increasing amount of forest produce for the requirements of the population, whilst at the same time proving a paying investment. The French Government commenced the afforestation of the Landes for purely protective reasons—but in its results it has turned out a very paying investment. The various objects to be attained by maintaining in perpetuity this large area of derelict land under forest appear to be of such considerable importance that it is at least open to consideration whether these interests would not be more assuredly safeguarded under State ownership than by any system of tenure which left open the possibility in the future of considerable tracts once again becoming not only useless but a danger to man.

AFFORESTATION WORK IN THE TERAI AND BHABAR LANDS

In addition to the remarkable afforestation work proceeding at Etawah and neighbouring localities, work of this nature has been commenced on the waste lands of the Terai and Bhabar Estate in the United Provinces, of which there are, it is understood, some 50,000 acres. Efforts had been made in the past to encourage cultivation in these tracts in the Bhabar, but owing to their malarious nature the results attained were poor, although better success has been achieved in the Terai. The Bhabar lands were originally covered with dense sâl forest, as is exemplified by the presence of isolated sâl trees still standing on the areas made over for grazing in the vicinity of the Government Reserves. Very large tracts were given up for the latter purpose to the established villages, with the inevitable degradation of the forest which has ensued. On a deserted village site at Dolpokra, half-way between Haldwani and Chor Galia, *shisham* was sown and planted pure some years ago. Good growth was attained, but the trees have since been attacked by a fungus, considered to be probably the same as the Changa Manga one, and many trees in the lines have been killed. A second plantation was started at Rampur Chaor in the neighbouring Ramnagar Division. *Khair* is now being utilized with the object of forming mixed crops with the *shisham* in order to discount the risk of the fungus, the mixture being a natural one. The plantations now being formed near Haldwani were commenced at the instance of the Governor of the Province with the idea of preventing the spread of *Lantana*, which is one of the most pestilential weeds

in parts of India. About 60 acres are being afforested a year here, 30 to 40 acres being irrigated. Trenches are cut and the *shisham* is put out as root and shoot cuttings, the *khair* being sown in between. The plantations are fenced against cattle. The following is a note by Smythies, in whose company I visited these plantations in 1925: "Very successful plantations have been made during the last five years in certain waste lands near Haldwani, notably: (1) About 300 acres in *lantana*-infested wastes near Haldwani itself. (2) Deserted old village lands in the Haldwani Division, about 100 acres. The method of creating these plantations is very simple. Where irrigation is available, *shisham* root and shoot cuttings are put out in March or April, in lines 10 feet apart, and irrigated weekly until the monsoon breaks in June. Thereafter no irrigation is required at all. The young plants are weeded once or twice in the first rains, at the end of which they are 4 feet to 6 feet high, and safe from competing weed growth in future. Where irrigation is not available, the cuttings are put out in June and have to be weeded for two rains, as the unirrigated growth is not so rapid as the irrigated growth. At first the plantations were made pure *shisham* and averaged 20 feet high in four or five years. But latterly, owing to the danger of the dreaded root fungus, it has been customary to sow *khair* in patches between the *shisham* plants. These are sown in June and during the first year only send up a very small shoot (4 to 6 inches). However, *khair* is very hardy against drought and frost, and does not appear to mind moderate competing weed growth, and after three or four years the plants are 6 feet to 10 feet high, very sturdy and growing strongly. Thus in the later plantations, even if the *shisham* is affected by the root fungus, there will be a good stock of *khair* to occupy the ground. These plantations cost Rs.12 to Rs.16 per acre to create and another Rs.3 to Rs.4 per acre for fencing. No financial forecast of results expected has yet been made, but that they will prove very profitable near the railway is practically certain."

RECLAMATION WORK IN THE PUNJAB

The denudation and erosion in the Pabbi Hills and the notorious Hoshiarpur *Chos* have for long proved difficult problems. The former of late has given anxiety owing to the effects it may have on important canal works. In the Quinquennial Review of Forest Progress, 1919-20 to 1923-4,



DOLPOKHRA OLD VILLAGE LAND—APRIL 1920—SHOWING SOIL PREPARATION FOR MAKING SHUSHAM PLANTATION
HALLIWANI DIVISION

Photo. by E. A. Smithies, I.F.S.



DOLPOKIRA SHISHAM PLANTATION, 5 YEARS OLD, APRIL 1925 (THE SITE AS THE ACCOMPANYING PHOTO
SHOWING SOIL PREPARATION EXACTLY 5 YEARS LATER). HALDWANI DIVISION

the Chief Conservator wrote: "An organized attempt has been made to stop the erosion of the Pabbi Hills and to reclaim areas already seriously eroded. Efforts have been mainly directed to prevention of the rapid flow-off of rain water from these generally barren hills, and to the regulation of the flow of water into the large nullahs by means of earthen dams behind which silt accumulates; a system of ridging and trenching along contours has been employed to retard the flow-off of rain water. Results of the work are promising; no attempt has been made to undertake operations on a large scale, as the work is still experimental. Sixteen hundred and fifteen acres have been treated so far. *Prosopis juliflora* (Walaiti Jand) is the most successful of all the trees sown, and will be the mainstay of afforestation operations. The growth of good fodder grasses has greatly improved. The total expenditure incurred on these operations was Rs.34,706; the average cost per acre on maintenance and new work during 1923-4 being Rs.5.10 and Rs.51.4 respectively. The experience gained will be of considerable value in extending such work to the Hoshiarpur Chos and the eroded hill-sides in the Ambala and Gurgaon Districts."

In a note on the subject (1925) Mayes wrote: "The Pabbi is a series of low ridges of sandstone which run from north-east to south-west a few miles to the east of the Jhelum River and parallel with it, crossing the main railway line from Lahore to Peshawar. These ridges are thinly covered with a stock of *Acacia modesta* and bushes with a few timber trees, such as *shisham* and *bakain* (*Melia Azedarach*) in the nullahs. There is a certain amount of denudation whereby the sand is carried down to the cultivated land below, but the most serious threat from the ridge is to the Upper Jhelum Canal which runs along the western foot of it between it and the river. The sandy torrents which come down on the western side of the ridge threaten sometimes a breach of the canal, and it is very largely to stop this that the afforestation work has been undertaken. The work at present is suspended owing to financial stringency, but it was being carried on until two years ago on lines similar to those in the United Provinces. It is to be stated, however, that results such as are obtained in Etawah and Cawnpore are not to be expected in the Pabbi for the reason that the rainfall is much smaller and the soil is shallow and poor. The only species which can be called a real success so far is *Prosopis Juliflora*, which

grows like a weed. *Kikar* (*Acacia arabica*) cannot stand frost and has been a failure, and other timber species such as *shisham* can only be grown with hope of success in the nullahs. In addition to the ordinary afforestation of tree species steps have been taken to grow fodder grass by ploughing and sowing seeds of better fodder species. This work has shown considerable success. . . . Efforts are being made to induce the villagers in various parts of the Province, particularly in the district of Gurgaon, to cooperate in a scheme for the reclamation of similar areas of barren denuded low hills. Forest subordinates trained in this work are being deputed to assist Deputy Commissioners in this."

On the subject of the *Chos* Mayes wrote: "The Forest Department so far has not been allowed to do anything with the management of the *Chos*. There is an Act, but it is operated by the Civil Department. The *Chos* Act came into operation about the year 1909, and the closures under it were at first extraordinary efficient, and there can be little doubt that if they had been continued on the same lines a very large amount of good would have resulted by now." The usual outcry against the strictness of the closures apparently took place and they were relaxed after a few years. A *Chos* enquiry Committee was recently appointed, but their report had not been issued in May, 1925.

CATCHMENT AREAS AND REBOISEMENT WORKS

In addition to the classic examples already dealt with several Provinces have catchment areas and small works of reboisement in hand.

Punjab.—The Simla water supply catchment area forest was originally under the Forest Department (cf. I, pp. 284, 476, and p. 125 *supra*) and was regularly worked under the Plan revised by Hart in 1896. In 1916, on account of fear of contamination of the water supply, the forest was entirely closed and no work has been done since (1925). There are also catchment-area forests for the water supply of Murree and Dalhousie. They are in the North-West Frontier Province and Chamba State respectively and are not under the Department.

Bengal.—The Senchal Catchment Area is worked by the Darjeeling municipality, but trees cannot be felled without the sanction of the Forest Department, who marks them for felling. In the Darjeeling Division a considerable amount of work has been accomplished in arresting and planting up

deep ravines such as the Pagla Jhora, the Seti-Khola Slip, etc., which are now completely stopped. In Kalimpong the Geological Department have been asked to advise with reference to stopping bad slips.

Assam.—The Shillong Pine Forests clothe the catchment area and are maintained primarily for this purpose. In the Naga Hills certain areas of natural forest are protected to ensure the water supply, and no fellings take place.

Bihar and Orissa.—Proposals have been made to acquire land in the Damodar River Catchment Area (Damodar Valley Scheme) for the purpose of afforestation in order to regulate the flow of water in the river. The catchment area has a scrub growth on it. Afforestation is considered to be practicable and would stop the destructive floods which sweep down into the country below.

Madras.—Reboisement work is being undertaken in the Kundah Reserve in the Nilgiris, where a system has recently been inaugurated under which an attempt is made to regulate fires so as to prevent them destroying the evergreen shola growth. A certain amount of sowing and planting of various kinds of trees has been done with a view to restore the sholas destroyed by fire.

CHAPTER XVIII

THE PROGRESS OF WORKING PLANS IN INDIA AND BURMA, 1901-25

WHEREAS the practice of silviculture has in the past few years witnessed a highly commendable renaissance in India, the same remark cannot unfortunately be applied to that important branch, Working Plans. With the exception of certain Provinces, the progress as a whole, when it is remembered that the department has been in existence for sixty years, cannot be termed satisfactory. Few would be found to dispute the point that the time has arrived when every forest in the country should be under a Working Plan. Its nature may be simple, but it should embody definite prescriptions with annual control forms to be submitted to the Controlling Authority. Mere plans of operation or five-yearly schemes offer no safe guarantee that a forest is under effective management or that the growing stock is not either being over- or under-felled. Moreover, the prescriptions of such plans are usually based on insufficient data, and are easily modified by the Civil Officer or the Divisional Officer with the assent of his Conservator. Furthermore they do not lay down a sufficiently definite working scheme for the forest area as a whole. In other words, a young Forest Officer with a correct knowledge of Forest Management, even if mainly theoretical at his present stage in the Service, may well exclaim that he does "not know what he is working for or what the management is aiming at." The mere prescription to work so many compartments or so much area during the next five or ten years, with improvement fellings over so much more, cannot be designated scientific forestry or the scientific working of an area. Even if a considerable tract is at present inaccessible, and therefore unworkable, it does not militate against its inclusion in a Working Plan as an at present unworkable Working Circle. The Working

Circle or Circles which can be exploited will be stock mapped, the description of the growing stock defines the degree of the enumeration undertaken, depending on the intensity of the plan; the area is divided into the desired number of felling series; Periodic Block I selected and Periodic Block II, if possible, indicated: and order and a scientific management, however simple, has been introduced into the working of a forest area and the staff know what they are about and the objects to be achieved. Further progress is then not only possible but a matter of certainty. Many of us never witnessed this introduction of scientific management, and there appears to be at the present moment far too large an area of forest into which this preliminary management has not been yet introduced in India, as this chapter will demonstrate.

Mayes (Chief Conservator, Punjab) strikes the right note in the following: "Moreover, intensive working of a forest and intensive silviculture are both impossible for areas which have not been placed under Working Plans. The longer this essential to correct forest management is delayed and the greater the period which elapses, the greater will be the delay in securing the full benefits of the intensive utilization which follows an intensive silviculture."

It has become apparent that those Provinces which have appointed Conservators of a Working Plans Circle have made the most notable advance. It will be generally admitted that rapid progress on up-to-date lines in India is impracticable in the absence of such a head to co-ordinate the work. Under present-day conditions the Conservator and Divisional Officer are very fully occupied with their administrative and territorial duties. Work of all kinds is more intensive, as is exemplified by the splitting up of areas formerly constituting single Divisions into two, three or four separate charges under separate Divisional Officers, which has been so marked a feature of recent progress. This of itself has brought into being an extra amount of urgent work for the Working Plans Officer.

The position to which the different Provinces have arrived in this important branch will now be considered.

I. WORKING PLANS IN THE UNITED PROVINCES AND OUDH

The United Provinces and Oudh have for long held the premier place in this field. The comparatively small areas of

the charges, when compared to those in other Provinces, the large population and consequent demand for materials, and perhaps to some extent the presence of the Forest School at Dehra Dun with the staff attached to it, led to the earlier introduction of Working Plans into the Province. The Director of the School was also Conservator of the School Circle for a number of years.

The area of forest under Working Plans, mostly of the selection type, in 1900 was 3448 square miles out of a total area of 4122 square miles of forest in the Province, and plans were being prepared for 222 square miles. In 1910-11 the area under Working Plans was 3779 square miles and plans were being prepared for 34 square miles. The next decade witnessed a revolution both in silviculture, as already detailed, and in Working Plans. The old Working Plans, based on the mis-named Selection System with the old type of improvement fellings, were revised and new plans were drafted, based on such scientific systems of forest management as Clear Felling, Shelter Wood Compartment (Uniform) and Selection-cum-Improvement, and yield tables for the more important gregarious species were in preparation. The modern Working Plan was, in fact, being based on scientific data instead of (mainly) guesswork.

The area of the forests under the Department was extended by the tentative formation of the Kumaun Circle sanctioned for three years on 2nd October, 1912. This step was mainly due to the initiative of the Lieutenant-Governor, Sir John Hewett, those forests having been previously under the Civil Department. The addition comprised an area of 3400 square miles.

In 1920-1, therefore, the total area of forest was 7442 square miles, out of which 4226 were under Working Plans, whilst Plans were under preparation for 2727 square miles, chiefly in Kumaun.

In 1923-4 the Department in this Province was in the eminently satisfactory position of having all the forests of the Province, with the exception of the Kumaun Circle, under Working Plans, many of these being intensive plans, the old ones having been revised within recent years. The total area of these plans covered 3964 square miles. This area included 17 square miles, mostly in the Afforestation Division, for which plans were not at the time required. Out of the total area in Kumaun, 3400 square miles, some 2139 square miles are

under intensive Working Plans, and for another 568 square miles the plans were nearly completed early in 1925. The remaining forest area of the Province consists of elevated or inaccessible areas for which plans are not at present required. Statistical tables of yield have been prepared for such species as sâl, deodar and *Pinus longifolia*.

This record in so essentially important a side of forest management is an excellent one and is a striking testimony to the high efficiency of the work carried out by former generations of officers in the Province. For an intensive Working Plan has usually to be preceded by one of a simpler nature, which has to be worked with knowledge if the area is to progress to higher things. The present satisfactory position may also be ascribed to the wisdom of the liberal policy of the Government in sanctioning the temporary posts of a Conservator of Working Plans and a Provincial Sylviculturist in 1920. These posts, subsequently confirmed in 1922, have been held by Messrs. Trevor and Smythies respectively. The Working Plans Circle has five Working Plans Officers on the cadre. The Chief Conservator and Working Plans Conservator select the Working Plans for revision and the former nominates the officers for the work as required. The Sylvicultural and Research Division is under the Conservator, Working Plans Circle, the Afforestation Division being also in this Circle. The Sylviculturist has two assistants. The work embraces regeneration experiments, artificial and natural, and the statistical work in connection with sample plots and the collection of data for the preparation of volume tables, etc.

Details of several of the more intensive Working Plans in force in the Province have been already given in the chapter on Sylviculture.

In Collier's "*Conversion*" to *Uniform Plan* of 1914 for the *Halduani Division* there was one felling series and six periodic blocks of twenty years, subsequently altered by amalgamation into three periodic blocks of forty years each. The annual yield was fixed in Periodic Block I by volume, based on a complete enumeration of all sâl over 3-foot girth in the block; in Periodic Block II by area (thinning with improvement fellings), and in Periodic Block III also by area (removal or girdling of the remaining overwood and thinning in the young sapling and pole crop). The structure of this plan proved very satisfactory in its practical application. It showed a very great advance on previous sâl Working Plans and, with necessary modifications, it has been adopted for later plans in other divisions.

The *Dehra Dun Plan* for 224 square miles of sâl forest is also under the Uniform System with a rotation of ninety years, and six periodic blocks, subsequently reduced to three of thirty years each. Periodic Blocks I and II have been selected, the former, the regeneration area, comprising one-third, and the latter one-sixth of the total area. The rest of the Working Circle is termed the Intermediate Periodic Block. Enumerations were made of all trees of 12 inches diameter and above, and the yield was calculated from the formula

$$Y = \frac{\text{Vol.} + \text{Incr.} \times 10}{20}, \text{ it being assumed that ten years of the regen-}$$

eration period had already passed owing to the existence of large areas of pole crops in parts of the regeneration block. The annual yield may be removed from anywhere in the regeneration area. The revenue from this Division for 1924-5 was Rs.6,48,000, with an average annual expenditure of Rs.1,40,000. Annual outturn, 920,000 cubic feet of timber (90 per cent sâl) and 1,350,000 cubic feet of firewood (cf. II, pp. 331-333).

2. WORKING PLANS IN THE PUNJAB

The progress made in the Sister Province had also been considerable. Trevor, who was an officer of this Province, drew up or revised some of its more important plans before his transfer to the United Provinces. Trevor also carried out research work into the silviculture of the deodar and other high-hill species.

In 1901, out of a total area of Reserved forests of 2897 square miles, 885 square miles were under Working Plans, practically all on the Selection System; for Protected forests an area of 1829 square miles out of 4888 square miles was under Working Plans, whilst for the Leased forests it is said that no effective plans were in force.

The position as it stood in 1919 is thus described by Mayes, then Conservator of the Eastern Circle, in a letter to the Punjab Government dealing with the urgent necessity of increasing the gazetted staff of the Province. He wrote: "Up-to-date Working Plans have so far been prepared for the Murree-Kahuta *chil* (*P. longifolia*) forests, over 105,000 acres; the Changa Manga Plantation, over 12,000 acres, while the Kulu Working Plan is just completed and covers 777,000 acres of forest. A Working Plan for the Kangra Forests, area 796,000 acres, is under preparation and is nearing completion.

Working Plans are urgently required for (approximate area in acres): the Sutlej Valley, Bashahr Division, 106,000;

the Pabar Valley, Bashahr Division, 34,000 ; the Kotkhai-Kotgarh Forests, Simla Division, 8000 ; the Jubbal State Forests, Simla Division, 64,000 ; the Tharoch State Forests, Simla Division, 24,000 ; the Kalesar Reserved Forest, Simla Division, 11,000 ; the Chamba State Forests, 68,000 ; the Reserved Forests, Hazara Division, N.W. Frontier Province, 151,000. Total area = 466,000 acres. It will thus be seen that new intensive Working Plans are required for 466,000 acres of valuable forests ; for the Working Plans in force either date from 1901 and onwards, and are based on the out-of-date Selection System, or are otherwise technically defective ; with the result that only 25 per cent of the possibility is being realized (*vide* results of the new Kulu Working Plan, to be mentioned later) or Working plans do not exist at all, as in the case of the Pabar Valley Forests, Bashahr Division. The work is urgent as the owners are losing money for lack of modern Working Plans. It is proposed to complete them all in five years. The work, being of a highly technical nature, can only be done by Forest Officers with experience of intensive forestry in Europe. It is proposed to place three Imperial and three Provincial Assistants on this work. On the expiry of the five years the amount of Working Plans work may decrease, but in Indian forestry knowledge is acquired and defects are detected as work progresses ; consequently Working Plans should be, and will be, frequently revised, and so the above staff is likely to be always fully employed. These revisions will bear largely on the accuracy or otherwise of the forecasted yield and of the sequence of fellings for regeneration purposes, the rest of the provisions of the Working Plan being more or less permanent for the twenty-five to thirty years ordinarily covered by such plans. The work to be done will be carried out as expeditiously as possible by the formation of six Working Plans parties, and if necessary of more, one Imperial Officer being in charge of two parties or more. As a Working Plan takes from one to three years to complete it will be seen that the personnel allotted for this very important branch of forest work in the Provinces is none too large to carry through the programme."

It will have been noted that there are three types of forests under the charge of the Department—Reserved, Protected and Leased—the latter comprising those forests leased from Indian States, e.g. Chamba, Bashahr. The Protected, which includes a considerable proportion of the total forest area

of the Province, are chiefly situated in Kulu and Kangra. They have been retained under Chapter IV of the Forest Act owing to the decision of the Settlement Officers that the requirements of the local population would thereby be better preserved. This is a survival of the past and is recognized by the Forest Officer to be an exploded fallacy at the present day, though it may be admitted there were good arguments in its favour in the past when the Department was young and inexperienced. To find it persisting in an up-to-date progressive Province like the Punjab is astonishing. The settlements are very complicated, which enhances the difficulty of drafting intensive Working Plans. By constituting these forest areas Reserves this unnecessary difficulty would be removed. But a more important point is the factor that the preparation of intensive Working Plans cannot be regarded as really satisfactory, nor can the expense incurred be justified, for forests in which the prescriptions could be upset at any time with the ease which is possible in the case of forests which are merely classified as "Protected."

The following statement exhibits the position of the Punjab in this branch of forestry in 1900-1 and 1923-4 :

Class of Forest.	Under intensive Working Plans.	Under simple Working Plans.	Without Working Plans.
	1900-1		
Reserved forests	20 sq. miles, or 0.69%.	865 sq. miles, or 29.86%.	2012 sq. miles, or 69.45%.
Protected forests	—	1829 sq. miles, or 37.42%.	3059 sq. miles, or 62.58%.
	1923-24		
Reserved forests	*384 sq. miles, or 29.61%.	82 sq. miles, or 6.32%.	831 sq. miles, or 64.07%.
Protected forests	1800 sq. miles, or 44.59%.	—	2,237 sq. miles, or 55.41%.
Leased forests	—	172 sq. miles, or 48.31%.	184 sq. miles, or 51.69%.

The decrease in the total area of forests is due to considerable tracts of "rakh" land having been given up to the Civil Department for colonization schemes with the opening of the magnificent new tripartite canal schemes which have come to fruition since 1911, as has been related in another chapter.

* *Figures of Kangra, Hoshiarpur, Kulu, Seraj, Rawalpindi and Changa Manga Working Plans.*

It will become evident from the above statement that the great progress in the preparation of Working Plans envisaged by Mayes in his letter of October, 1919, had not matured. Several reasons might be advanced, such as the shortage of experienced men and the number of juniors joining the Department after the war. But in work of such importance as the placing of forests under Working Plans these arguments scarcely have the weight their advocates attribute to them. The formation of a Working Plans and Research Branch was sanctioned with effect from the 1st April, 1923. Neither Working Plans Conservator nor Sylviculturist has yet been appointed (1925). In this connection the Chief Conservator writes in the Annual Report for 1923-4 (p. 4): "No suitable officer was available to take charge and the Chief Conservator has controlled any operations undertaken independently of the ordinary executive staff." In 1925 he wrote (Memorandum for Professor Stebbing, dated May 4th, 1925): "Although at present no officer is available to be appointed to the charge of the Working Plans Branch its necessity is fully recognized and one will be appointed when the necessary staff is available."

The *Kulu Working Plan* is an example of the modern intensive Working Plan for the hill forests. It was commenced in 1915 and completed in 1919. There are four Working Circles: (1) Regular Working Circle—Forests of deodar, blue pine and oak mixed in places with spruce and silver fir on moderately easy ground to be worked under the Uniform System. (2) Fir Working Circle—Pure spruce and silver fir worked on Uniform System. (3) Selection Working Circle—Deodar, pine and fir which are exploitable, but owing to configuration of ground regular treatment is not possible. (4) Unregulated Working Circle.—All demarcated but at present unworkable forests not included in other Circles.

The rotation of the Regular Working Circle is 120 years, with four periodic blocks of thirty years each. Only compartments of Periodic Block I have been definitely allotted. The order of fellings is decided by the Divisional Officer under control of the Conservator. Compartments in Periodic Block I to be regenerated under the Uniform System. These compartments were difficult to select as *owing to the heavy grazing rights of the local population* it is not possible to close large areas in any locality. An annual volume yield is prescribed. All trees of 12-inch diameter and over in Periodic Block I were enumerated in 3-inch diameter classes and the resulting volume calculated from yield tables. The increment to middle of the period was added and total divided by number of years in period to obtain annual yield. Similar prescriptions were made for the Fir Working Circle, except that the rotation is 150

years with five periodic blocks. In the Selection Working Circle, only deodar over 12 inches in diameter were enumerated; an annual volume is prescribed, fellings to be made on silvicultural requirements. In the Unregulated Working Circle trees can be removed for right-holders or local demand. Thinnings and improvement fellings have been prescribed in the Regular and Fir Working Circles in the compartments allotted to other than Periodic Block I.

3. WORKING PLANS IN BURMA

One of the most striking developments (there are others as interesting) in Burma is the formation of the Working Plans Circle with five parties at work, the sanctioned number being nine. The Circle consists of five branches: (1) Working Plans, Record and Control, (2) five field W.P. parties, (3) Silviculture, (4) Entomology (temporarily vacant), (5) Botany.

Mr. H. R. Blanford, the Conservator of the Working Plans Circle, at the author's suggestion, kindly drew up the following lucid account of the progress in Burma during the present century. It may be suggested that it merits the closest study by some of the other Provinces, for the War hit them all in the same manner in reducing the ranks of fully experienced officers. Blanford was anxious to bring his W.P. parties up to full strength and deplored the shortness in experienced officers. The problem was discussed at length and the author suggested the following *ad interim* way out of the difficulty. The nine parties to be formed as follows: four to five Major Parties with experienced Deputy Conservators in charge for intensive Working Plans work, four to five Minor Parties in charge of Assistant Conservators, who would undertake stock mapping work, etc. The junior officers to be in charge of parties for, say, two years and then to be sent back to divisional work. In this way the smartest of the junior officers could subsequently be picked for posting to the charge of Major Parties. Important work would not be delayed and the Working Plans Conservator would be enabled to form an estimate of the aptitude of the junior officers for this type of work. Blanford's Memorandum is as follows:

" (1) *Position at Commencement of Period.*

(a) *Area covered by Working Plans.*—The position on the 30th June, 1900, was as follows: total area of Forest Reserves 17,153 square miles, area under Working Plans 1817 square miles, or 10.6 per cent of total area. (Note.—This omits 217 square miles of Unclassed Forest stated to be under Working

Plans in the Salween and Thaungyin Divisions.) Area of Reserved Forest in which Working Plans were under preparation, 1043 square miles or 6·1 per cent of total area. The preparation of Working Plans was in progress in the Pyinmana and Toungoo Divisions. (b) *The type of plan.*—Plans were based on a 25 per cent enumeration of all species. Teak was enumerated in 18-inch girth classes up to 6 feet girth, 6 feet to 7 feet girth and 7 feet and over. The other more valuable species were enumerated in less detail. Yield was fixed by the number of first-class teak trees, the yield being calculated on the basis of the removal of all first-class trees over a period considered sufficient to replace them. The system of management adopted was the Selection System and Improvement Fellings were prescribed. (c) *Control.*—The Conservator was the controlling officer, but all final control was centred in the office of the Inspector-General of Forests. All plans, after being passed by the territorial Conservator, were forwarded to the Inspector-General of Forests, who obtained the sanction of the Local Government.

(2) *Progress during the Period.*

(a) *Areas covered by Working Plans.*—Early in the period under report it was felt that progress in Working Plans was not sufficiently rapid, and in 1904-5 it was recommended that for the less valuable teak forests in the Province plans should be drawn up on somewhat more sketchy lines than had previously been the custom. It was proposed that plans should be based on a stock map and an enumeration of teak only over about 10 per cent of the area by linear surveys. The yield should be fixed by area and silvicultural rules, and no attempt to fix a yield by number of trees was to be made. This type of plan was shortly afterwards adopted in some of the forests of the Chindwin and undoubtedly increased the progress of the preparation of Working Plans, though this was still hampered by lack of qualified officers. In 1907-8 Mr. F. Beadon Bryant, Chief Conservator of Forests, considered that it was essential to draw up rough plans for the exploitation of mature and overmature teak in order to provide more systematic girdling for the leases which were being entered into with large firms for the greater portion of the Burma Forests. Girdling schemes based on area control were drawn up for whole Divisions by the Divisional Forest Officers for ten to twenty years, and annual girdling coupes

were fixed. While these schemes did allow extraction to be carried out on organized lines, they were not based on a sufficiently long felling cycle to allow of the first-class trees being replaced by increment during the period of the plan. Although it was intended only to remove the mature and overmature trees, in practice the girth limits fixed were the same as would have been fixed under a Working Plan on the Selection System, where the felling cycle would usually have been thirty years. Moreover, the schemes were often based on a very slight knowledge of the forests and led to very uneven results. It is possible, from the greatly increased revenue in Burma in the period 1920-5 that the drop in the yield of teak which is regarded as probable during the next few years will be entirely due to the excessive girdlings under these schemes, most of which were only of fifteen years duration. During the early part of the period, Working Plans were completed over the greater part of the forests on the Pegu Yomas and the forests in the Chindwin, Ruby Mines, and Thaungyin were taken in hand. Little further change in the type of plan was made until 1914, when field work on Working Plans in the Province was brought to an abrupt close by the Great War. During the War little progress in the preparation of Working Plans in the field could be made owing to the scarcity of officers, many of whom were taken away for military duty. It was not until the formation of the Working Plans Circle in 1920 that any further progress can be recorded, but, in the meantime, opinion in favour of Working Plans for whole divisions had ripened, and this policy was adopted soon after the creation of the Working Plans Circle at the beginning of 1921. The first step taken was to review the Working Plan position for the Province. Owing to the increased demand, more especially for timbers other than teak, and to the somewhat serious position due to the fact that girdling schemes drawn up in 1907-8 were mostly coming to an end, Working Plans revision was extremely urgent. At the same time, the staff of officers qualified to carry out the work was seriously depleted owing to the lack of recruitment during the War and the steady loss of officers owing to retirement, a loss that was made more severe by losses in the War (five officers of the I.F.S. from Burma were killed in action). It was therefore proposed to supplement ordinary preparation of field work by drawing up paper plans for whole Divisions which could carry on

until the necessary field work could be undertaken, and would form a useful preliminary basis for more elaborate plans. At the same time, such field work as could be undertaken by officers available was confined to areas which would come under working in the next ten years only until the situation was again normal. Considerable progress has been made, and with the increase of staff due to post-war recruitment it is again possible to undertake field work on a larger scale and for the whole area of a plan. At the same time, the area for which new Working Plans or revision of old Working Plans is required is still very large, and for some years rough paper plans, with which considerable progress is being made, must be relied on for many Divisions. The following statement shows the position : (1) On 30th June, 1920, when the Working Plans Circle was formed. (2) On 31st March, 1925. The figures are inclusive of the Federated Shan States which was separated from Burma in 1922 :

	30th June, 1920.		31st March, 1925.	
	Sq. miles.	Per cent of total area of Reserves.	Sq. miles.	Per cent of total area of Reserves.
1. Reserved forests under sanctioned Working Plans	10,855	36	12,379	39·9
2. Reserved forests for which Working Plans were under preparation	328	1	3,760	12·1
3. Reserved forests for which Working Plans were urgently required	6,888	23	5,064	16·3
4. Reserved forests for which Working Plans are not urgently required	11,803	40	9,835	31·7
Total area of reserved forests	29,874	—	31,038	—

In addition to regular Working Plans 7415 square miles of Reserved Forests and 25,583 square miles of Unclassed Forests were being worked under girdling or other schemes.

System of Management.—No attempt to alter the system

of management for teak forest was made until the Working Plan for the Mohnyin Forests in Katha was revised in 1909. As this was the first attempt in Burma to depart from the so-called Selection System that had up to then been adopted with little change since regular Working Plans had been commenced in Burma it is as well to give some details of the methods prescribed. A rotation of 180 years was adopted, and a regeneration block of one-ninth of the area and stocking was selected for the regeneration block in the first twenty years. The method of regeneration was Clear Felling with natural regeneration over one-fourth of the regeneration block every five years, as it was found that where teak seed-bearers were plentiful a complete removal of the cover followed by burning produced ample regeneration of teak. Later on, however, the Working Plan was revised to allow of areas being regenerated annually, and it was found that artificial reproduction with the assistance of *taungya* was cheaper and more satisfactory. The yield of teak was calculated, but was not laid down by volume, and control was entirely by area. Selection Fellings to remove over-mature trees only were prescribed over other blocks on a thirty-year felling cycle.

The first Burma Forest Conference of 1910 marks the turning-point in the management of Burma teak forests. Mr. R. S. Troup, who was then Superintendent of Forest Working Plans at Dehra Dun, brought up proposals for the adoption of a system to be known as the system of concentrated regeneration in the Tharrawaddy Division. His proposal met with considerable opposition, and a majority passed a resolution at the Conference that the Selection method would be generally suitable for teak were it practicable to carry out the necessary Improvement Fellings at proper intervals. At the same time, the Conference was in favour of more concentration of Improvement Fellings, and recognized that any concentration of Improvement Fellings on an organized plan would tend towards the eventual formation of a series of more or less even-aged crops. It was decided that Mr. Troup's proposals should be adopted in the revision of the Working Plans for the Tharrawaddy Division, and it is with the history of this Working Plan that the change of policy can best be traced. The field work for the revision of the Working Plans in Tharrawaddy Division, five in number, was commenced in 1911-12 by Mr. E. V. Ellis and continued

in 1912-13. After the first season's field work the figures for sample plots compared with the original enumerations made when the plan was first drawn up in 1884 showed that the numbers of teak in the younger-age classes had increased. On this result the Conservator, Pegu Circle, came to the conclusion that the Selection System was a proved success, and recommended that Mr. Troup's proposals should only be adopted over one block of forest in the Division and that the rest of the Division should continue to be managed under the Selection System. The block to be managed under Mr. Troup's proposals was first of all a very accessible block, but later on, on the grounds that this block contained too many immature trees, one of the least accessible blocks in the Division was selected for this most important experiment. Fortunately the Province was visited early in 1914 by Mr. G. S. Hart, Inspector-General of Forests, who criticized these proposals and suggested that the original recommendations of the 1910 Conference should be carried out, and that the whole Division should be worked on the system of concentrated regeneration. There was considerable delay in carrying out the revision, and it was not until 1918 that the Working Plan was finally drawn up. It was sanctioned in 1919. Briefly, the Tharrawaddy Yoma Forest Working Plan laid down a rotation of 120 years. One-sixth of the area considered suitable for concentrated regeneration was selected in the most accessible areas in the Working Circle in several blocks and was allotted for regeneration in the first twenty years. A further area, equal to one-sixth of the total area suitable, was set aside for regeneration during the second period of twenty years. No attempt was made to allot areas to the other periods of the rotation. Selection Fellings of mature trees over all blocks, except the regeneration block, were laid down on a forty-year felling cycle. Fellings in the regeneration block were to be largely experimental until the best method of regeneration had been discovered, though Clear Felling followed by natural or artificial reproduction with *taungya* was indicated as the most probable method.

By the time work under the Tharrawaddy Working Plan was commenced, however, opinion in favour of the concentrated regeneration system for teak forests had strengthened. The successful regeneration work carried out in the Mohnyin Reserve in Katha and in Tharrawaddy and North Toungoo Divisions had shown that regeneration could be carried out

successfully. Later work in Mohnyin had shown again the great advantage of *taungya* plantations over most other forms of natural or artificial regeneration and, although other methods of concentrated fellings with natural regeneration were suggested under the Tharrawaddy Yoma Working Plan, these were soon found to be far more difficult and expensive in the moist deciduous forests of the Pegu Yomas and could not generally compare with the results attained in *taungya* plantations. The actual system adopted may therefore be described as Clear Felling. The successful launching of the Clear Felling System in Tharrawaddy Division led to a wave of enthusiasm for the system over the whole of Burma, and it was not for some years, and after a certain amount of badly organized work, without due attention being paid to extraction of all marketable timber before regeneration felling, that it was realized that the system was not suitable for universal application. With the formation of the Working Plans Circle and the appointment of a Sylviculturist in 1921 the policy in connection with methods of management has gradually settled down on lines which promise some permanence.

As far as teak forests are concerned these are :

(1) *Areas accessible to extraction of floatable timbers only, more especially teak, and which are likely to remain inaccessible to the extraction of other timbers for a considerable period.*—The Selection System must be continued, but the proportion of teak must be maintained and, if possible, increased by means of Improvement Fellings with a view to the removal of a proportion of the stock of valueless species equal to the amount of teak removed by extraction. Increase of the stock by *taungya* plantations of teak may be undertaken, but should be secondary to the formation of plantations under the Clear Felling System in more accessible localities.

(2) *Areas accessible to the extraction of heavy timbers.*

(a) *Required for the supply of timber and other forest produce to the local inhabitants.*—These will be worked under the Clear Felling or Uniform System, either by coppice, natural regeneration or artificial regeneration with *taungyas* as suitable for the various types of forests. The rotation to be sufficient for the production of small timber, house posts and fuel only. Areas must also be allotted under this head for the supply of bamboos. A number of small felling series

conveniently situated for local supply will be formed. The yield will be fixed by area for the present.

(b) *Areas available for local or export trade of timbers other than teak.*—These will also be worked under the Clear Felling or Uniform System, under a longer rotation and with larger felling series. For the ordinary teak-forest type the method of regeneration will be Clear Felling and artificial reproduction, but other types of forest may have to be managed under the Shelterwood Compartment or even under the Group system.

Yield Control.—Until recently no attempt was ever made to control the yield of any species except teak. In the earlier plans the yield of teak was controlled by fixing the number of first-class trees to be taken out either annually or during a period. This number of trees was based on the surplus of mature trees *plus* the number of trees calculated to pass beyond a certain girth limit. The calculations were based on countings over some 25 per cent of the area, and the periodical yield was fixed on the assumption that a sustained yield was a primary consideration. The weak points in the calculation were the fixing of the tree, a unit variable between wide margins, as the standard unit and the further vitiation for control purposes of this unit by leaving the definition of a sound tree unstandardized. In later Working Plans the yield was fixed by area subject to a girth limit and the application of silvicultural rules. The introduction of Clear Felling and the necessity of avoiding over cutting, when part of the yield was to be obtained by Clear Felling over a regeneration block, and part by Selection Felling of mature trees over other blocks, showed the absolute necessity of controlling the yield by some formula based on the volume of the growing stock. In the absence of volume tables, and pending their preparation, it was decided to substitute basal area for volume and to control the yield of all forests for which sufficient data of the growing stock were available by a variation of Von Mantel's formula following the practice recently adopted in the United Provinces. The formula actually adopted was: $\text{Yield} = V \times \frac{1}{4} R$, where V = basal area of growing stock over 3 feet girth (no enumerations having been done below this girth in most Working Plans) and R = rotation. While it is admitted that a control based on this formula must necessarily be very rough, it is proposed to recalculate it on fairly frequent recounts of the growing stock.

Passing and Control.—On the appointment of the Chief

Conservator of Forests in 1905 the control of Working Plans was taken over from the Conservators, but the sanction for Working Plans was still obtained from the Local Government through the Inspector-General of Forests. In 1911 the Chief Conservator of Forests was authorized to put up plans direct to the Local Government for sanction. On the creation of the office of Forest Research Officer in 1913 the check of control forms was handed over to that office and was finally located in the office of the Conservator of Forests, Working Plans Circle, on the creation of that post in 1920. The present method of control aims at a complete record of all work carried out in Reserved Forests and all markings and fellings of teak both in Reserved and Unclassed Forest."

The Zigon Working Plan may be taken as a typical model of modern Burma Plans. The plan is drawn up for the whole division. The areas are classified as easily accessible, capable of being made accessible to extraction by cart, accessible for floatable timber and inaccessible. Based on this classification, four Working Circles have been made. (1) Teak Working Circle (of less accessible forest). (2) Local Trade Supply Working Circle (accessible). (3) Kangyi Working Circle (special selection, accessible). (4) Village Supply Working Circle (small areas of accessible forest). The prescriptions are as follows: (1) *Teak Selection Working Circle*.—Teak is the only species saleable and yield is regulated by basal area, based on the modification of Von Mantel's formula already described. Rotation is 150 years, the usual rotation for selection forest in Burma. Girdling cycle is thirty years. The felling cycle is divided into five-year sub-periods. Selection fellings to be carried out with a minimum girth of 7 feet 6 inches, the progress of girdling being regulated by progress with extraction. Only teak is considered. Regeneration by *taungya* in order to give employment to Karens who have privileges to cut *taungyas* in the Reserves within this Working Circle (*vide* II, p. 60 *ante*). (2) *Local Trade Working Circle*.—To be worked by concentrated regeneration following concentrated extraction. Girdling teak is regulated as in No. 1 Working Circle. Concentrated felling of teak before regeneration counts against the yield for the whole division. Rotation 100 years. The area to be regenerated annually is based on total effective area of Working Circle divided by rotation. Selection of areas included in the regeneration block is based mainly on accessibility, but also on presence of existing plantations in compartments, some of which already contain large areas of these, and on existing population willing to undertake *taungya* work. Provision for allotment of areas to maintain the future bamboo supply is also made. Detailed instructions *in re* girdling and extraction, improvement fellings and thinnings in the old and new

plantations are also embodied. (3) *The Kangyi Working Circle*.—This comprises a valuable natural Reserve, approaching nearer to true Selection than most other forests in Burma. It is of the lower mixed type, with few bamboos, and is accessible. For this reason it has received much attention in the past, with benefit to the growing stock. It is to be managed on intensive Selection System. Growth is rapid, an average girth of 80 inches being attained in sixty-eight years. Rotation fixed at seventy-five years. The plan prescribes to work up to a preliminary felling cycle of ten years in order to place the forest in a normal condition as rapidly as possible. Operations prescribed are : First year.—Girdling of all teak above 7 feet 6 inches girth and of unsound trees. Fourth year.—Girdling or marking for felling species other than teak ; felling and extraction of girdled teak. Fifth year.—Extraction of girdled and marked trees of species other than teak. Sixth year.—Girdling and marking of teak and other species as a thinning or cleaning. Seventh and eighth years.—Extraction of species other than teak girdled or marked in the sixth year. Ninth year.—Clearing up the compartment. Fire protection is prescribed, as also thinning and cleaning of old existing plantations. (4) *Village Supply Working Circle*.—Is divided into a number of small felling series situated at convenient intervals for the supply of village requirements for small timber, house posts and fuel. Rotation of fifty years fixed tentatively. Yield calculated by area, with concentrated regeneration following concentrated extraction. Choice of species is based on demand and ease of regeneration, *taungya* being prescribed. General prescriptions are embodied in the plan for roads, buildings, boundaries, further reservation, control of rights, and so forth, and a financial forecast.

WORKING PLANS IN THE BOMBAY PRESIDENCY

Most of the Working Plans in this Presidency were drawn up after 1900, only 9.49 per cent of the total area of the forests being under plans at the commencement of the present century. Considerable progress has been made with this work, 63 per cent of the total forests being managed under the prescriptions of plans by the end of the year 1923-4. A large amount of work remains to be completed and the revision of plans, which will constantly come up, points to the desirability of the early formation of a Working Plans Circle. For several years, especially after the first decade of the present century, no regular Working Plans Officers were appointed. Since 1923 three officers have been appointed, one for each of the Presidency Circles—Northern, Central and Southern.

The only existing (1925) intensive Working Plans are :
(1) Made by Mr. Edie (the present Chief Conservator) for the

High Forests of the Kanara Eastern Division. This plan is based on Clear Felling followed by artificial regeneration. It was started in 1919 and sanctioned in 1922. (2) The Thana Working Plan for pure coppice made by Mr. Aitchison in 1921. This plan covers parts of three Thana Divisions. Edie's plan applies to a part of the Division, and the same is the case with the plan now being drafted by Mr. Davis for the North Kanara Division, which the author had the pleasure of discussing with that officer. Except in Sind, where two of the plans each apply to an individual Division, whilst a third has been prepared for three Divisions, no one plan in this Presidency covers an entire Division.

This practice of preparing a Working Plan for part of a Division is a peculiarity which appears to apply to Bombay alone. It was adversely commented upon by Hart when he visited the Presidency as Inspector-General of Forests in 1917. The method is expensive and is contrary to the ordinary accepted procedure and practice which govern the preparation of plans. Another point upon which Hart commented was the formation of an excessive number of felling series.

New plans were in course of preparation in 1925 for the following :

<i>Northern Circle.</i>		<i>Central Circle.</i>		<i>Southern Circle.</i>	
	sq. m.		sq. m.		sq. m.
Surat Dangs	266	West		Kanara, E.D.	14
West Nasik		Khandesh	190	Kanara, S.D.	61
(Peint)	90	Poona	11	Dharwar-	
East Thana	1			Bijapur	287
	<u>357</u>		<u>201</u>		<u>362</u>
<i>Total, 920 square miles.</i>					

Plans had still to be taken in hand for the following :

<i>Northern Circle.</i>		<i>Central Circle.</i>	
	sq. m.		sq. m.
West Nasik	26	West Khandesh	250
Surat	2	Satara	425
North Thana	1	Poona	72
West Thana	12		
	<u>41</u>		<u>747</u>
<i>Southern Circle.</i>		<i>Sind Circle.</i>	
	sq. m.		sq. m.
Kanara, S. D.	57	Shikarpur	1
Belgaum	249	Hyderabad	7
	<u>306</u>		<u>8</u>

This statement appears to emphasize Hart's contention that many of the plans in this Presidency could be combined. The revision of so large a number of plans, the total runs to ninety-seven for the Presidency according to a list furnished to the author, covering small areas which apparently could form a separate Working Circle of an existing plan, in many cases will prove an expensive business. In the reorganization scheme drawn up in 1918 a Working Plans Conservator and a Research Officer were proposed. It appears unfortunate that the proposals were not given effect to. The following tabular statement exhibits the position of the Presidency at the beginning of the century and the progress made to date.

PROGRESS IN WORKING PLANS FROM 1899-1900 TO 1923-4

Year.	Total area of forests sq. m.	Under sanctioned Working Plans.		Area not under Working Plans.		
		Actual area sq. m.	Per cent of total forests.	Plans under preparation sq. m.	Plans not under preparation.	
					Required at present sq. m.	Not required at present sq. m.
1899-1900	14,053	1334	9.49	6038	6681	—
1909-1910	12,601	—	—	593	5677	—
1919-1920	12,579	7841	62.3	1360	1280	2098
1923-1924	12,485	7872	63.0	920	1101	2591

Under revision in 1919-20, an area of 1995 square miles was due or required to have plans revised; and revision of plans over an area of 2850 square miles was in progress at the end of the year. In 1923-4 the figures for the same were 1257 and 648 square miles respectively. The expenditure incurred in 1923-4 under Working Plans was Rs.15,697. The three following plans exemplify the modern type:

The Thana Forests Working Plan.—The area is 974.1 square miles. There are three Working Circles: (1) The Main Working Circle, the greater part of the area, medium sized mixed forest with 25 per cent of teak. (2) Pole Working Circle. Part of forest near coast-line. (3) Bamboo Working Circle. An overlapping Working Circle, comprising all forests containing bamboos. There are 135 felling series in (1) and twenty-two in (2). In (3) felling series comprise three or more of the felling series of (1) and (2). Main Working Circle objects are production of timber and highest

financial results subject to silvicultural requirements and local demand. In the Pole Working Circle growth is poor and the area is worked for poles and fuel. The two Working Circles are worked on the Clear Felling System with coppice and artificial regeneration. The Bamboos are treated on a three-year felling cycle. The rotations are eighty and forty years respectively. The yield is by area. Teak is to be increased to 50 per cent and is to be protected, as also *tiwās* and blackwood, against *Terminalia tomentosa* and fast-growing soft woods (*injaili*). Annual felling area in (1) is 6750 acres, and in (2) 954 acres. In Bamboo Working Circle no shoots of the preceding monsoon to be cut, and one-third of the green shoots of each clump is to be left. Standards from the old Coppice with Standards to be felled when not required, as also trees damaged by former fires. After exploitation cultural operations to be carried out for two years in each coupe, and a cleaning in fifth year, and thinnings, etc., subsequently. There is a good demand for teak timber, teak poles, firewood and charcoal.

The Yellapur and Mundgod Teak High Forest Working Plan.—Was prepared by Edie for an area of 124,284 acres. Large-sized teak occur in western half, from 10 to 23 per cent. The growing stock has suffered from fire in the past. The old system was Selection, except in north-east, where it was under a modified Coppice with Standards. Four Working Circles are prescribed. Working Circle 1, comprising the western half, with Blocks I to VI; rotation, 120 years. Working Circle 2 consists of Blocks VII to XV, medium-sized forest; rotation, ninety years. Working Circle 3, poorer class forest, Blocks XVI and XVII; rotation, sixty years. Working Circle 4: areas available for grazing, if required. System is clear felling, one coupe annually in each block. The debris on area is then burnt and area artificially restocked by sowing or planting. Improvement Fellings to be carried out annually in Working Circle 1 by compartments, and in 2 and 3 in coupes adjoining the regeneration coupes. Improvement fellings only to be undertaken in Working Circle 4. Owing to scarcity of labour only half the area of the Working Circles 1-3 will be gone over in twenty years. Rules are prescribed for the silvicultural work. Strict fire protection is enforced except in Working Circle 4.

If prescriptions are fulfilled the revenue should rise from 2 to 6 lakhs per annum.

Upper Sind Forests Working Plan.—The plan is made for three Forest Divisions: Larkana, Sukkur and Shikarpur. The forests form separate and connected blocks, with a total area of 408,711 acres, situated for some 208 miles on both banks of the Indus River from north to south. The annual rise of river between May and July is a factor chiefly influencing forest growth through the extent of the inundation area. *Kandi* (*Prosopis spicifera*) predominates, but *babul* (*Acacia arabica*), *lye* (*Tamarix specigera*) and *bahan*

(*Populus euphratica*) occur more or less throughout, except *babul* in Upper Sind. One Working Circle is prescribed. Each felling series averages 2000 acres and contains thirty coupes, the rotation, based on the growth of *kandi*, being thirty years. The system is Clear Felling, with coppice and artificial sowings. Groups of *babul* standards to be reserved to produce large timber. Owing to constant danger from erosion by the river, the possibility of each felling series is liable to change, periodical recalculation being necessary. Annual coupes receiving annual irrigation are to be broadcasted with *kandi* and *babul*, according to incidence of irrigation and soil. Agricultural operations may be necessary at times. The two latter species are thinned in sixth, eleventh, sixteenth, twenty-first and twenty-sixth year. General rules are laid down *re* afforesting blanks, treatment of *Kachas*, grazing, fire protection. Firewood is the chief product, some timber and charcoal. Net annual revenue is estimated to average Rs.2,00,000.

WORKING PLANS IN THE MADRAS PRESIDENCY

Working Plans have not progressed very rapidly in the Southern Presidency. The attitude of Governments towards the Department in the past is to some extent responsible, as history well exemplifies. But there appears to be little doubt that the Forest Authorities did not realize the imperative necessity of placing forest areas under a plan, however simple its provisions, at as early a date as possible. Even at the present day the opinion appears to be held in some quarters that there are only a few areas in the Presidency which require intensive plans. In 1925 there were only four intensive plans in the Presidency: (1) the fine Working Plan for the Nilambur Teak Plantations, area 127 square miles; (2) plan for the Nilgiris and Ootacamund Plantations, area 3 square miles; (3) plan for the Mount Stuart Forests, area 40 square miles; and (4) the plan for the Gumsur Sâl Forests, area 603 square miles.

For the rest of the forests the Chief Conservator wrote: "The area under simple Working Plans is 5485 square miles and that without Working Plans is 7511 square miles. The simple Working Plans are, as a rule, merely arrangements for allocating fuel coupes. . . . Proposals for the formation of a Working Plans Circle are now before Government and await provision of funds by the Legislative Council."

With the almost total absence of good Working Plans in the Presidency which the above statement discloses, it is difficult to believe that the provision of funds for any other

forest work can be more important, in the true interests of the Madras Forests, than the allocation required for a Working Plans Circle. And to the interest of the forests may be added the retention of the keenness of the younger generation of the Presidency Forest Officers which was most noticeable during the author's visit. Even if a considerable area, now to be made over to Panchayats, produces fuel only, it is common knowledge that on the Continent of Europe such areas, often communal forests, are carefully safeguarded by up-to-date Working Plans. The idea, which apparently finds adherents, that Working Plans are only required for areas producing timber, is entirely fallacious. The following are the prescriptions of three of the above-mentioned plans :

Nilambur Valley Working Plan, 1921.—This has to some extent been dealt with in Chapter XVI. It prescribes two Working Circles. In the Plantation Working Circle the old crops are to be clear felled at seventy years and replanted with teak on suitable areas. For the rest of the forest a Conversion Working Circle has been formed. A definite area of the old natural forest will be clear felled annually. All saleable material will be removed, and the rest burnt, the area to be restocked artificially by sowing or planting. Pure crops of teak will be planted on suitable soils, and elsewhere the next most valuable species suitable to the soil conditions and silvicultural requirements as pure crops. Bourne has compiled money and volume yield tables for the Nilambur Teak Plantations.

Gumsur Sâl Forests Working Plan (Ganjam), 1921.—The forests are allotted to seven Working Circles, as follows: 1. Plains Sâl Timber Working Circle. A definite area to be clear felled annually in Periodic Block I and Improvement Fellings in other periodic blocks. In the area clear felled, after removal of material, burn debris and shortly after cut back to ground the uneven regrowth of sâl coppice coming up, with subsequent tending of the even crop thereby obtained. 2. Plains Sâl Pole Working Circle. Sâl areas on the extreme limit of the habitat of this species. Big timber is not obtained, but excellent poles and fuel to be worked on rotation of twenty-five years. 3. Ravine Sâl Working Circle. Working similar to Working Circle 1, but as in places the sâl is not pure, a certain amount of artificial regeneration of species other than sâl is prescribed. 4. Selection Working Circle. Comprises large areas of forest in the hills containing scattered sâl and other mixed deciduous species. A cycle of Selection Fellings is prescribed to realize the mature timber. 5. Lower Hill Fuel Working Circle. Non-sâl bearing areas intermediate between 2 and 6 Working Circles. System is simple coppice, on a rotation of twenty-five years. 6. Scrub Jungle Fuel Working Circle. Forests to south and east of

sâl areas carrying a mixed deciduous crop of fuel-yielding species. System, simple coppice; rotation, twenty years. 7. Bamboo Working Circle. Bamboos are not plentiful. Areas containing a sufficient crop included here and worked on a rotation of five years. Mr. A. A. F. Minchin prepared this plan, which was favourably commented on by Hart.

Mount Stuart Forests Working Plan, 1919.—These forests lie to the extreme west of the Anamalai Hills, elevation 2000 to 3000 feet. Objects are to replace a deteriorated crop of mixed species, of which teak and rosewood are the most valuable, by a series of pure woods. The Mount Stuart Working Circle, the only one being worked, has been divided into fifty annual coupes for selection fellings. The original idea was to clear fell as big an area annually as the labour available could manage in the Selection felling coupe and regeneration by sowing teak. Since this would result in a number of small isolated teak woods which was undesirable it was prescribed that artificial regeneration should be concentrated in one place and that other valuable species besides teak should be raised as pure crops, according to the varying locality factors. The present procedure is to clear fell areas up to 250 acres (they were smaller at first) each year and sow them up. Teak is the only species sown as yet on a large scale, though *Terminalia tomentosa* is raised on areas unsuitable for teak. Selection fellings are carried out as originally laid down. Mr. H. F. A. Wood prepared the plan.

WORKING PLANS IN BENGAL

The Forests of Bengal fall under three denominations, viz.: Reserved, Protected and Unclassed. Of the Reserved Forests, 94 per cent are under Working Plans (1923-4) as follows: Sundarbans and Chittagong, 100 per cent; Darjeeling, Kurseong, Cox's Bazar, 99 per cent; Buxa, 94 per cent; Jalpaiguri, 91 per cent, and Chittagong Hill Tracts, 88 per cent. The revised plan for the Kalimpong Division had not received sanction at the time. The plans for the three Chittagong Divisions were new ones and had been recently sanctioned. The plan for the Jalpaiguri Division was under revision and was expected to be sanctioned in 1925. The work for the revision of the Buxa plan has commenced, and the author had the pleasure of discussing some of the points in this plan with the Working Plans Officer, Mr. Macalpine.

Practically all the Protected Forests are in the Sundarbans Division, an area of 1702 square miles, all of which is under a Working Plan. The Unclassed Forests are all in the three Chittagong Divisions, the bulk in the Chittagong Hill Tracts and Cox's Bazar. Plans have not been necessary for these

areas up to date. It is believed that the old unrestricted felling and transport down the rivers is to be replaced as early as possible by more systematic working, and it is to be hoped classification as Reserves combined with a regulation of the *jhuming* (shifting cultivation) which has persisted far too long. A study of the lines upon which the regulation of *taungya* by the Karens in Burma (*vide* p. 60 *ante*) might indicate a suitable procedure. Working Plans will then be required for this area.

The intensive Working Plans existing in 1923-4 were those for the Darjeeling, Kurseong and Sundarbans Divisions, though some of the revisions will bring other plans into this category. This brief review will show that Bengal holds a very creditable place owing to the manner in which she has taken up this important branch. It would appear as if a Working Plans branch would become a necessity in a not distant future. The Plans for the Northern Forests are typical of the progress.

The Northern Bengal Plains Forests Working Plans, 1920.—The previous history of the plains sâl forests has been already given in Chapter XVI. E. O. Shebbeare's plans for Jalpaiguri and Buxa, based on clear felling and *taungya* regeneration, came into force in 1920. They prescribed in addition to clear felling, selection fellings over the areas not under regeneration. The clear fellings were complicated by the fact that of the three kinds of produce, sâl, other timbers and fuel, all growing together on the same area, each had to be worked up to its possibility on rotations fixed at eighty, forty and twenty years respectively. These plans being experimental were prescribed for five years only. No enumerations were made and the prescriptions were entirely mechanical. They resulted in *taungya* being started in almost every felling series, although the area so felled and regenerated in the Jalpaiguri Division amounted to only 10 per cent of the prescribed possibility. Macalpine is now revising these plans. The main objects of the revision are the same, but several modifications have become necessary. Clear felling with *taungya* is still the system supplemented by cautious Selection fellings to eke out the existing stock. Enumerations and stock maps form a necessary feature in order to render the prescriptions more adaptable to existing conditions.

The Darjeeling Working Plan.—The early history of these forests has been already detailed. The first intensive Working Plan was made by Mr. F. B. Manson in 1892-3. It provided for felling half the crop and then sowing and planting up. It did not state how soon the remainder of the crop was to be removed; the idea was, however, that it would be in the sixteenth year. The rotation was 160 years, with five periods. Mr. B. B. Osmaston revised the plan

ten years later, and removed the shelter wood over the young crops, which were inevitably much damaged in the operation. No new regeneration fellings were undertaken. Improvement fellings were made. It was debated whether Clear Felling was practicable.

In 1912 Mr. Grieve's plan was introduced. He first excluded all areas open to grazing. All areas regenerated under the twenty years' previous work were formed into a Plantation Working Circle. He then divided the rest of the area into a High Forest and a Coppice Working Circle, the latter to be worked on a thirty years' rotation for the supply of fuel to the tea gardens. Grieve's prescriptions for the High Forest Working Circle broke down owing to the alterations made in the plan after it had left his hands. But it appears that he was too optimistic as to the abundance of natural regeneration in these forests. What was actually prescribed in the Working Plan, as issued, was group fellings, on the European pattern. As worked the groups really became Clear Fellings because, owing to absence of seed bearers, considerable planting had to be done. Baker made the next plan. He divided the whole of the hill forests of Darjeeling and Kurseong Divisions into a Long Rotation Working Circle (125 years) and a Short Rotation Working Circle (forty to sixty years, according to locality). Both are to be clear felled and restocked by *taungya*, as at Toong and Takdah, as already described.

WORKING PLANS IN BIHAR AND ORISSA

The Province of Bihar and Orissa was separated from Bengal in 1912. The chief Divisions of the Province are those formed from the old Singbhum Division, which is now split up into the Saranda, Kolhan, Porahat and Chaibassa Divisions, the latter of which only consists of protected forest areas in the agricultural part of the district. The position of the Province as regards Working Plans is as follows: the three Divisions—Saranda, Kolhan and Porahat—have Working Plans covering an area of 720 square miles. There are two Working Plans, both intensive, the one for Saranda and the Kolhan and the other for Porahat. The former plan was revised, the revision coming into force on July 1st, 1924. The Porahat Working Plan came into operation in 1919. Both plans prescribed intensive working under the Uniform System (partly Clear Felling) under a contract with the Bengal Timber Trading Company, who have a monopoly in Saranda and Porahat, but not in Kolhan. The other Division under an intensive Working Plan is Sambalpur, which dates from 1921. The plan is mainly for coppice. The Uniform System was first started in Porahat in 1919. The prescriptions for tending

operations for the Singbhum Divisions have not been able to be carried out owing to the Bengal Timber Trading Company being in arrears with their fellings. The introduction of the Uniform System is considered to be the right one, but so far its trial has been short and it is too early to speak of the results which the Working Plans will give.

The Puri and Angul Forests have been managed under an elementary Working Plan, but are now being worked under a preliminary scheme based upon new Working Plans which should come into force in 1926, the system being the Uniform one. All other Reserves are under working schemes, based mostly on the Coppice System. For the Protected forests working schemes are in force, about a third of the area of those forests under the charge of the Department being under these schemes. No schemes for the working of the areas of Protected Forest under the management of the Civil Authorities are in existence.

It will be apparent that the Province has a good deal of work to cope with. The more important Working Plans will be briefly considered.

Saranda and Kolhan Working Plan.—This plan covers the area which originally contained old sâl forests (II, pp. 391, 392, 395). There are 4 Working Circles: (1) The Conversion Working Circle. (2) Hill Working Circle. (3) Miscellaneous Working Circle. (4) Coppice Working Circle. The Conversion Working Circle is the one of main interest. It includes all the best sâl divided into felling series, each divided into six twenty-year periodic blocks of approximately equal reduced areas. Concentrated regeneration fellings are prescribed for Periodic Block I, the selection for felling being left to the Divisional Officer. Clear Felling to be adopted where regeneration warrants it. Where deficient, remove overhead cover gradually. Assist artificially, if required, at end of period. In other Periodic Blocks make Improvement fellings of various degrees, the exploitable girth varying from five to six feet. In Periodic Block II the main object of the fellings, which are really preparatory fellings, is to induce natural regeneration. The regeneration period is thus one of forty years. Period of conversion is 120 years, which for definite reasons is higher than the financial rotation. Thinnings on a ten-year cycle are prescribed for pole crops in Periodic Blocks I and II. The yield in Periodic Block I is fixed on the unit system, based on a complete enumeration of all trees over 3 feet in girth.

The Porahat Plan is drawn on much the same lines, with necessary modifications, the main object being the production of large timber. The Chief Working Circle is the High Forest one with two felling series and a conversion period of 140 years. The second

Working Circle is Coppice with Standards, the Standards being retained in groups.

The Sambalpur Forest Working Plan.—A large local demand for fuel, house posts, etc., exists. Five Working Circles have been formed: (1) High Forest Working Circle, mainly sâl. Two felling series designed to convert forest to Uniform condition. They are managed on different systems. In the First there are five twenty-year Periodic Blocks of approximately equal reduced area. In Periodic Block I clear felling in narrow fixed strips laid out in south-west direction is prescribed. Narrow Cutting Series have been formed and adjoining strips are to be felled at five years' intervals. Object is to provide side protection to the semi-established regeneration. Coppice regeneration is relied upon with artificial aid where necessary. In the other Periodic Blocks Selection-cum-Improvement fellings with exploitable girth fixed at 4-5 feet. Conversion period is 100 years. In the Second Felling Series, which contains little sâl, only one Periodic Block is fixed. Clear fellings are prescribed and Coppice regeneration relied on to supplement the natural. No fellings are prescribed in rest of area. (2) Special Coppice Working Circle. Mainly sâl of good quality and a demand for poles, etc. The object is conversion to a Uniform crop of large poles. Three felling series, each divided into three twenty-year Periodic Blocks of approximately equal reduced area. In Periodic Block I clear fell and regenerate by Coppice shoots, assisted by natural regeneration and artificial. Groups of small poles, and occasionally Standards, to be retained. In rest improvement fellings with minimum girth of 4 feet. Conversion period, sixty years. Order of fellings is fixed. Thinnings on a ten-year cycle. (3) General Coppice Working Circle. Sâl and miscellaneous with a local demand. Forty-eight fellings series. In each a modified Coppice with standards is prescribed, the standards to be in groups. Period of conversion varies for each felling series from twenty to fifty years, according to intensity of demand, etc. (4) Miscellaneous Working Circle. Only fifty green trees to be cut annually. (5) Bamboo Working Circle. The bamboo is *D. strictus*. Is not territorially distinct from other Working Circles. Twenty-seven felling series worked on a three-year rotation. In each clump all culms under eighteen months, and six green older culms to be left uncut. Fire protection is confined to regeneration areas and young Coppice crops in all Working Circles.

An interesting feature of these three Plans is that where Periodic Blocks have been formed they have all been definitely fixed. The reason given is that there is little real difference in the state of regeneration which is good in all blocks and risk of external danger is small. "Fixation of all Periodic Blocks," says the writer, "has the advantage that each block can be worked so as to be in the optimum condition when due for final felling."

WORKING PLANS IN THE CENTRAL PROVINCES AND BERAR

The Central Provinces is another of the Provinces which has been backward in dealing with Working Plans. The only intensive Working Plans are the one in the Southern Circle for the South Raipur Sâl Forests (it does not apply to the mixed forests), and two in the Berar Circle, the Yeotmal Plan, a good plan dating from 1917, and the Melghat Plan. There are also the Sironcha and Nimar Plans. The Allapilli Plan in South Chanda (Southern Circle) was originally made by Clutterbuck in 1895 and has undergone moderate revision, and now requires to be brought up to date. The Nagpur-Wardha is about twelve years old. Most of the other plans in all three Circles are antiquated, running from thirty years back onwards. They are practically of very little use, the stock mapping having been based on insufficient data. Therefore the fact that 81 per cent of the total area of forests in the Province (16,077 square miles) is under Working Plans gives rather a misleading idea of the true position. The procedure has been to carry on with modifications of existing so-called plans or, in the Northern Circle, with new working schemes, both methods equally to be deplored as subversive of true scientific forestry and leaving open the power to overcut, whether through ignorance or otherwise.

In the Annual Report of the Province for 1921-2 the Chief Conservator (Farrington) wrote: "The question of the preparation or revision of Working Plans in North Mandla, Seoni, Hoshangabad, Saugor, Damoh, Jubbulpore, Narsinghpur, North Chanda and Betul requires very early consideration." In the Report for the following year he stated: "The following Working Plans, some of which are shortly expiring, require revision or modification more or less urgently: Sâl High Forests of Baihar and Raigarh Ranges of Balaghat, Mixed Forests of North Chanda, Betul, Nimar, Melghat, Nagpur-Wardha, Seoni, Mixed Forests of South Chanda, Hoshangabad, Jubbulpore, Narsinghpur and Damoh."

That new Working Plans drawn up on up-to-date lines are an urgent need is evidenced by the practice which had come into force in some parts of subdividing the coupes of the thirty-year cycle, half only being sold at a time in order to obtain better work from the contractor. The result has been that a higher price was, in some cases, obtained for the half-

coupe than was previously realized for the whole, and better work is being accomplished. But such a procedure is complicated. Its practice not only points to the urgent need of a new Working Plan but seems to go further and to indicate that Divisions in this condition require splitting up into smaller charges.

The reason for the introduction of this division of the coupes is explained by the Chief Conservator as follows: "As regards our Teak Forests, it became evident during the year that with the exception of the Allapilli Forest we are attempting to work over areas that are too large for efficient control and full working, and a Report was submitted to Government. The readjustment of areas on a longer felling cycle has been approved for certain forests and coupes will be confined to areas that can be worked over in one year. It is hoped that the past neglect to tend felled areas in subsequent years will also be remedied, even if it entails further curtailment of coupes in the main fellings and the abandonment of recently opened felling series. There can be no excuse, except the realization of immediate revenue at the expense of the future yield, for expansion in the latter direction while worked areas demand further treatment." Which bears out the remark already made anent overfelling in the absence of the safeguard of an up-to-date Working Plan.

The present Chief Conservator, as has been shown, was strongly of opinion that Working Plans work is an urgent need of the Province from the forestry point of view. The Government had, however, taken up the attitude that owing to the large number of young officers in the ranks progress in Working Plans must cease until the junior officers had experience of divisional work. It will be admitted that the attitude was sound from one point of view. But all Provinces were in the same position, and yet some are carrying out most important work of this nature. Recently, in 1925, the Government changed their attitude. It is proposed to form a Working Plans Division under an Imperial Officer, including three parties, each consisting of an Extra Assistant Conservator and two Rangers. These parties were to commence Working Plans work in the cold-weather season of 1925-6. This is certainly a step in the right direction, and we may hope to see this Division blossom out into a Working Plans Circle in an early future. For such a Circle is undoubtedly required. The following intensive plan merits mention.

South Raipur Working Plan.—The first tentative Working Plan for these forests was made in 1900. It proposed three Working Circles, only one of which was worked on the Coppice with Standards system. Little work was undertaken under the plan, but fire protection was extended to cover most of the area. A revised plan was made in 1914. It provided for a *Sâl* Working Circle of eleven felling series and a Mixed Forest Working Circle of many felling series. This plan failed owing to insufficient Stock-mapping and smallness of demand. The plan sanctioned in 1925 applies to the *sâl* areas only. Conversion to Uniform is prescribed. The local demand is small and sleepers are to be the main output, the success of the plan being dependent on the construction of a 2-foot gauge light railway into the forest. There are three overlapping Working Circles. (1) High Forest Working Circle, including the whole of the *sâl* areas, the prescriptions applying to all areas where they are obviously relevant. (2) The Lac Working Circle, including all areas where *Schleichera trijuga* and other lac trees are found. (3) The Bamboo Working Circle, including compartments where bamboos occur in workable numbers. The forest has been allocated by compartments to five Periodic Blocks of twenty years each. The oldest block is to be first converted, thinnings and improvement fellings being undertaken in the other Periodic Blocks. Regeneration is said to be fairly abundant over a large part of Periodic Block I. No procedure has been laid down as to the manner of removal of the overwood. To some extent the problems here are similar to those of the United Provinces Terai *sâl* areas. Fire is made use of and early burning prescribed. In the Lac Working Circle regeneration of *Schleichera trijuga*, the most important lac tree, is to be assisted. Cultural operations, such as lightening the shade, pruning, and so forth, to be undertaken. In the *Bamboo* (*D. strictus* chiefly) Working Circle there are two felling series, each with three annual coupes. One coupe in each felling series is cut annually, the others being closed. Grazing is regulated.

WORKING PLANS IN ASSAM

Working Plans work in Assam has not got very far beyond the elementary stage. It is somewhat difficult to say to what the very backward state of this Province in forestry is due. The show Division has always been Goalpara, which is analogous to and properly belongs to the Bengal Eastern Duars (Buxa). Mr. W. F. Perree made the Working Plan for this Division which received sanction in 1906-7. It expired in 1920-1. It was revised, but it is understood that the revision did not go up to the Inspector-General of Forests and the Divisional Officer is in practice still working under the prescriptions of the expired plan. The Goalpara Forests

have a very high value ; it is thus obvious that the revision of this plan is an urgent matter. Other plans by Mr. Milroy are in existence for Kamrup and Shillong, and this exhausts the number. Some enumeration surveys in evergreen forests are being carried out. Of these the Sadiya one for 752 square miles appears to have been done on rather wide lines. Others are as follows: 1922-4, Lakhimpur, 5393 acres ; 1921-4, Sibsagar, 6401 acres ; and 1922-4, Darrang, 10,308 acres, or an area (with Sadiya) of 786 square miles in all.

The total area of the Reserved Forest is 6353 square miles and the area of the Unclassed Forest, 15,855 square miles. In 1921 only 29 per cent of the Eastern Circle was under Working Plans, and 24.6 per cent of the Western Circle. A Province with the large amount of undeveloped forest wealth such as Assam possesses can only hope to realize its assets by a progressive policy backed by sufficient funds.

The Kamrup Sâl Working Plan, 1919.—There are several interesting points in connection with this plan, the drafting of which was governed by limitations in staff, labour and money.

Three Working Circles were formed : (A). Established Plains type forest Working Circle. (B). Potential Plains type forest Working Circle. (C). Hill type forest. (A) consists mainly of pure sâl poles, originating since fire protection was introduced soon after 1870 with small remnants of primeval forest. It includes all the pure sâl pole areas in the hills. (B) consists of the most recently reserved areas, consisting of clumps of poles standing in a sea of thatch grass, much of which is full of young sâl plants. (A) type has risen from (B) type within the memory of man. (C) comprises areas of steep rugged hills with isolated clumps of sâl on hilltops and ridges, only the finest stems of which are saleable. Bamboos and inferior species occupy the rest of the area. (A) Working Circle. The treatment prescribed is heavy thinnings with annual burning, the latter to get rid of the dense undergrowth of evergreens which fire protection has given rise to. The burning has proved successful in its object, which is to gradually bring the forest floor into a state to obtain natural regeneration where required. Thatch grass has come in and burning will be continued as long as required. (B) Working Circle. Fire protection is all that is required. Given protection for five to six years the sâl poles are out of danger. This is difficult, as the local villagers are not educated enough yet to appreciate this necessity. (C) Working Circle. Areas opened in rotation for sale of standing trees, which are mostly made into boats. *Taungya* was started here, but the cutters gave it up when the Forest Officers required them to put in the plants at the usually accepted spacing. Had the latter been content with rigid conditions considerable

progress, it is said, might have been made. Milroy writes : " The question of *taungya* is of the greatest importance, seeing that the area of the Hill type forest is 91,404 acres, against 30,902 acres of Established Plains type and 14,217 of Potential."

Shillong Pine Forests Working Plan, 1922-3.—A point of interest is the realization, from the working of the old plan, that the forests were kept too dense and that regeneration is easily obtained after agriculture. Attention had to be paid to amenity considerations owing to the presence of the station to which the pine woods add beauty. Wide vista lines were cut and leased for potato cultivation for three years. It has become evident that abundant regeneration will be obtained at the end of the period. Broad fire lines are maintained, and where possible these are placed under potatoes and add to the revenue. Timber is required for the station and is readily saleable.

These plans indicate, when added to the much-needed revision of Perree's fine Goalpara plan and the *taungya* work being undertaken in Cachar and Sylhet, that a start, small though it may be, has been made in Assam, and that given staff, funds and leadership the management of the Assam Forests should rapidly improve, with a resultant increase in revenue.

CHAPTER XIX

THE RECORD OF THE FOREST DEPARTMENT DURING THE GREAT WAR, 1914-19

AS was the case in other Departments of the Civil Administration in India, the Forest Department was called upon to take its part in the momentous struggle which opened in August, 1914. The first call upon the Department came when many of the junior officers joined the Army, being granted commissions in the Indian Army Reserve of Officers. Since recruiting for the Imperial Service ceased between 1915 and 1918, this in itself threw additional work on the more senior officers, in many cases Circles having to be doubled up and, far more commonly, a Divisional Officer having to take charge of two or more Divisions. Professional work perforce came to a standstill, as was the case in France, where practically the whole of the junior gazetted ranks joined the fighting forces. Later on, when the enormous demands in timber and other forest produce required by the Military Authorities to carry on the work of War became apparent, a very large amount of additional and urgent work was demanded from the personnel of the Department and several Provinces were called upon to play an exceedingly and quite unforeseen part in the War. It would be difficult to speak too highly of the zeal and energy and patriotism of the officers who successfully coped with the operations required, many of whom had wished to join the forces in the field. The Department will for ever honour its representatives who, away from the limelight and glamour of active service, carried out, amidst the solitude and hardships inseparable from such work in great forest tracts, duties in connection with the supplies indispensable to the prosecution of the War. The following brief summaries from Reports which Sir Peter Clutterbuck, Inspector-General of Forests, and Chief Conservators kindly collected for me will display both the nature of the work, the provision made for

timber, grass, etc., required for the fronts in Mesopotamia, Egypt, Salonika, Aden, East Africa, Persian Gulf Ports, etc., and the methods by which the supplies were collected. These operations were commenced in 1917. At the beginning of that year the Government of India were asked to make arrangements to supply timber to the Armies in the various Eastern Fields. The Indian Munitions Board was formed in May, 1917, and Sir George Hart, Inspector-General of Forests, was appointed a member to control the forest work. Deputy Controllers were appointed in Burma (A. Rodger) and Bombay (C. A. Malcolm). Under Hart were R. S. Troup, Controller, succeeded by R. M. Williamson (1917) and H. V. Holberton, R. G. Marriott, H. C. B. Jollye and E. A. Greswell, Assistant Controllers. The Provinces mainly concerned in the work were Burma, the Punjab, United Provinces, Central Provinces, and the Bombay Presidency. The Research Institute at Dehra Dun under Perce was also called upon to assist and carried out many important investigations in the Economic Branch under Mr. R. S. Pearson. As has already been made evident in Chapter XIV, it was the War work carried out by the Department which led to the recognition by the Government of India of the great value of research and by the Department of the possibilities of utilizing many of the so-called, up to then, valueless "jungle woods."

Lists of Forest Officers who joined the Forces are given in the *Indian Forester*, May, 1923, and March, 1924.

INDIAN MUNITIONS BOARD—TIMBER BRANCH

Before dealing with the individual work of the several Provinces the following summary of the operations of the Timber Branch of the Munition Board represents the nature and magnitude of the work undertaken :

"The statement on page 533 summarizes the operations of the Timber Branch from its organization in April, 1917, to the end of October, 1918. The figures include bamboos, but not wooden railway sleepers which have been included under the head 'railway track' or wood fuel, the supply of which was not made by the Board.

The quantity of timber and bamboos is expressed in tons of 50 cubic feet.

In order to enable indents to be met without delay (the extraction of timber from the forests being possible as a rule

FOREST DEPARTMENT DURING THE WAR 533

only during certain seasons of the year) and to season the timber before despatch, as far as time allowed, the Board established large depots in Bombay, Rangoon and Karachi. The total balance of stock in hand in the three depots at the end of October, 1918, was 42,624 tons, viz.: 22,693 tons (including 347,849 bamboos) in Bombay, 13,720 tons in Rangoon and 6211 tons in Karachi.

Every effort has been made to substitute indigenous timber for foreign supplies, in order to reduce the demands on shipping

OPERATIONS OF THE TIMBER BRANCH FROM ITS ORGANIZATION IN APRIL, 1917, TO THE END OF OCTOBER, 1918

Destination.		Indents received. Tons	Amount shipped or despatched. Tons	Balance to be supplied. Tons
Over- seas.	Egypt	64,116	56,904	7,212
	Mesopotamia	131,406	121,386	10,020
	Salonika	19,624	15,647	3,977
	Other places (Aden, East Africa, Persian Gulf Ports, etc.)	10,106	3,744	6,362
	Total	225,252	197,681	27,571
India		46,052	30,395	15,657
Grand total		271,304	228,076	43,228*

to a minimum and to encourage as far as possible the use of the locally grown material.

It may be mentioned that the principal fraction of the timber supplied has been in the form of sawn beams, planks and scantlings, and the conversion of this has presented great difficulty (elsewhere than in Burma) owing to the very limited number of sawmills existing and the impossibility of importing additional plant.

Apart from supplying timber and bamboos for structural work, e.g. the construction of bridges, piers, wharves, buildings

* Of this amount 19,395 tons was ready for shipment or despatched on 31st October, 1918.

and temporary huts and lines, the Board has provided wood of suitable species for the construction and repair of craft, telegraph poles, bamboos for river training works, tent and mosquito poles. In addition it has engaged on an exhaustive search for timber suitable for use in aircraft. Numerous promising species have been tested, two of which have been approved by the Home Authorities while others are still under trial."

BURMA

Mr. A. Rodger of the Forest Department was appointed Deputy Controller (Timber Supplies) in Burma. He describes the work carried out in Burma under his supervision as follows :

"The first practical step taken by the Military Authorities to get into communication with the Forest Department in Burma was the despatch by a Royal Engineer Officer at Bombay, who was in charge of the collection and despatch of timber overseas, of a list showing the timber that would probably be required, and this was followed by a definite order for about 3000 tons monthly. A large number of sizes of planks, scantlings, squares and round logs were given, and preparations were made by the Chief Conservator of Forests in March, 1917, to collect the required timber at Rangoon. The first arrangements were made with the Divisional Forest Officers of Pyinmana, North and South Toungoo, Insein, Tharrawaddy, Zigon and Prome, and timber began to arrive in April. As there was no Forest Officer at Rangoon who had the time or the establishment to receive the timber, the Forest Research Officer was sent down from Maymyo to undertake this.

Depots.—We were led to understand that the timber was so urgently required that it would be removed as soon as it had been collected at Rangoon, and the first arrangements were made on this basis. A small beginning was made at the Sule Pagoda Wharf, where a certain amount of timber of all sizes was collected for shipment from the wharf. The first timber deposited there was mostly bought from the timber merchants of Rangoon, and was principally *In* and *Pyinkado* which had to be bought because the Forest Officers could not get it down in time for the first ship which sailed about the middle of April. It was recognized that it was essential for economical handling that the railway trucks from up-country should deposit their timber near the shore, whence it could be



INDIAN MUNITIONS BOARD. WAR TIMBER. SLEEPERS PILED AT SOOLAY PAGODA WHARF READY FOR SHIPMENT. 1917

Photo. by A. Kodger



INDIAN MUNITIONS BOARD, WAR TIMBER DEPOT, LAZUNDAUNG CREEK, RANGOON, 1917

Photo. by A. Rodger

removed easily to the ships. The Sule Pagoda Wharf was apparently not suited for a permanent depot as the Port Commissioners could, as a rule, allow us to have only a limited amount of storage room for a limited time, and a more permanent depot was made in the Government Timber Depot at Alon. Here the Port Trust had constructed a main siding with a number of branches which led right up to the water's edge, for the collection of stone for the river training works. As they had not used these for some time, they allowed the Forest Department to use them and a depot was started all round the siding, where the timber, as it arrived, was piled, size by size. It was found, however, almost immediately, that the room available would not be nearly sufficient and the Bombay-Burma Trading Corporation, Limited, kindly offered a piece of land on the bank of the Pazoondaung Creek, near Monkey Point. A main siding to the Burma Oil Company's and other works ran along just behind this land, and it was an easy matter to build a branch from this as far as the bank of the creek. The land has been rented from the Bombay-Burma Trading Corporation, Limited, and has proved invaluable. During the early rains of 1917 trucks began to arrive in ever-increasing numbers, sometimes as many as forty a day, and it was found necessary to build another double siding, and finally a third, as the ground under timber amounted by the end of 1917 to about 12 acres. A fourth depot was opened at the end of 1917 at Botataung on land belonging to the Railway Company, where large quantities of sleepers and of Padauk for ordnance work were collected. A fifth depot was opened in the hot weather of 1918 at Latter Street Wharf for metre gauge sleepers only. In addition to these a large number of round logs were collected in the yard of the Irrawaddy Flotilla Company's sawmill at Alon, where they could be handled by cranes, but this was given up after a few months as it was found that loading of long logs into cargo boats was difficult and a few Padauk logs only are kept there now.

In 1917 a considerable quantity of timber was collected at Moulmein, in the hope that it would be possible to send ships there to remove it. This, however, has been found to be impracticable, and the timber originally collected, as well as large quantities of squares and heavy planks of teak and other woods, and of railway sleepers, subsequently purchased, are now being railed to Rangoon for shipment from the wharves or the depots.

Unloading, Storing and Loading the Timber.—As the quantity of timber, and number of different sizes that arrived began to increase, the difficulties of collecting and handling them economically at Rangoon increased in proportion. Logs and large squares were the most difficult to handle, and the whole of these are now sent to the Sule Pagoda Wharf, where they can be handled by a steam crane or by coolies. The round logs are stacked and loaded on to trollies for shipment by the steam crane and the squares are loaded and unloaded by coolies, trollies being used to put them alongside the ship at the wharf. Loading is quicker and easier alongside wharves than in the stream, but the room for storage is very limited. As far as space has been available, sleepers and heavy scantling have also been collected at the wharves, but a large quantity of this material has been sent in cargo boats. At the Alon and Duneedaw Depots jetties have been built and cargo boats are loaded there with sleepers, scantling and planks. These cargo boats go alongside the ships in the stream or at the wharf. A crane has been brought from Wegyi and is used for handling heavy timber at Duneedaw. Recently, for example, a raft of *Taukkyan* squares arrived from Henzada and was put alongside the jetty at Duneedaw, the squares being lifted out one by one and put on to trollies. When several ships have arrived at one time there has been a great rush to keep them going, and all methods of transport have been employed; rafts, cargo boats, railway trucks and bullock carts, and the depots have had, at times, to work night and day for weeks on end. All the timber is tallied as it arrives and as it leaves, and numerous registers of all kinds are kept up, some 50 to 100 clerks and 200 to 500 coolies being employed in the depots. All unloading, stacking and loading is done by contract, the rate being per ton, the rate for loading by cargo boats including the hire of the boat for four days. A large quantity of teak, cut to the specified sizes, is purchased from the timber firms in Rangoon. This is passed at the mills by Forest Officers and then loaded on to the ships by the firms, the rate paid being f.o.b. and payment being made on the mate's receipts, so that this is much the easiest way of sending off any of the timber. All timber (except railway sleepers) is marked with the number of the indent, the designation of the consignee and the destination.

The Munitions Board.—In May, 1917, the work of supplying timber to the war fronts was taken over by the Indian

Munitions Board, and the Forest Research Officer was appointed Deputy Controller of Timber Supplies under the Board.

Special credit is obtained from the Board, and this is allotted to the various Divisional Forest Officers as required. Separate accounts are kept by Divisional Officers, and these are audited at the office of the Deputy Controller in Rangoon and are then sent on to the Controller of War Accounts, Munitions Board, at Delhi or Simla.

Detailed invoices are posted to each consignee with full details of each consignment of timber that leaves Rangoon, and these are returned receipted with note of discrepancies.

On the receipted issue-vouchers adjustment of the cost is made with the Military Authorities by the Controller of War Accounts.

The Supply of Timber from the Forests.—The whole of the timber now despatched is supplied on indents received from the Controller, Timber Supplies, Simla, and all the sleepers are purchased and despatched according to similar requisitions from the Railway Member of the Indian Munitions Board. Large indents are divided up into portions corresponding to the quantities each Divisional Forest Officer can supply and smaller indents are placed in one division. About 30,000 tons of round logs have recently been collected all over Burma, and these are held at the disposal of the Board for supplying new indents, and also those partly complied with. The timber was at first obtained largely from stocks held by local saw millers and from logs that were got out before the roads were closed by the rains in 1917. Many of the indents received in 1917 were for planks and scantling of various sizes, but these have been gradually changing until now squares and heavy planks are mostly in demand. Large quantities of teak squares and heavy planks and enormous supplies of jungle wood of the same size have been supplied for building wharves and bridges, and very large demands were received for smaller timber for hutting, trench work, etc. Bamboos are much in demand for river training works, *kyakatwa* of large size being found suitable. Spars up to 60 feet long of teak and *In* have been collected by the thousand for piles, Toungoo having sent very fine teak spars and the Ruby Mines splendid *In* spars of great length.

Telegraph poles, box woods, teak of many sizes for munition factories in India, wagon-building timber, wood for carts,

boats, aeroplanes, engine-shed floors and many other purposes have been collected and sent.

A feature of the demand is the great lengths asked for, squares and heavy planks being at present almost always demanded in lengths of 20, 25 or 30 feet or more. This should be especially noted in view of the difficulty that Forest Officers have in inducing contractors to bring out long lengths. The great part of the heavy work in organizing supply was done to begin with by Divisional Officers and their Assistants in the Pyinmana, North and South Toungoo, Mu, Katha, Tharrawaddy and Zigon Divisions. Large quantities of timber were also collected and despatched by the Divisional Officers of the following Divisions: Prome, Bassein, Insein, Henzada, Pedu, Nyaunglebin, Thaungyin, West Salween, Ataran, Shwegyin and Ruby Mines.

As a result of continued large demands, the Divisional Officers of Thayetmyo, Lower Chindwin, Meiktila and Mandalay Divisions have also provided of late a great deal of excellent timber, and it is hoped that supplies may be obtained in the future from even more distant forests. The Divisional Officers of the Rangoon, Mandalay and Moulmein Depot Divisions have also done much valuable work in supervision of depots and in receiving, passing and despatching timber.

The Supply of Railway Sleepers.—Arrangements for the supply of railway sleepers are made on behalf of the Railway Member of the Munitions Board and over half a million had been shipped up to the end of June, 1918. Four lakhs of narrow-gauge sleepers were supplied in response to an urgent demand, and more than half of these have now been shipped. Broad-gauge sleepers have been ordered to the extent of 1 lakh a month, and these have been arriving at Rangoon with great regularity. Metre-gauge sleepers were not ordered until 1918, but a large number have been already collected; about 50,000 have been sent off, and probably 4 lakhs will be required. In addition to these thousands of point or crossing sleepers of various lengths, for the metre and broad-gauge lines, have been sent away. Broad-gauge sleepers were sent away to the extent of about 4 lakhs in July, August and September, 1918.

Species of Timber Supplied.—Teak has been sent in very large quantities for wharves and for railway work, and to a small extent for minor works, such as carriage building,

buildings and engine-shed floors. Very large quantities of teak have also been sent to the munition factories at Dum Dum, Cawnpore, Jubbulpore, Ishapore and Cossipore. Teak has also been supplied to the Royal Indian Marine at Bombay and Calcutta, to the Calcutta Port Commissioners, the Eastern Bengal State Railway and others, and to the Arsenal at Rangoon. Padauk has been sent to India and Egypt for ordnance work.

A large percentage of the squares, scantling and planks has consisted of *In* (*Dipterocarpus tuberculatus*) with a good deal of *pyinkado* (*Xylia dolabriformis*), *taukkyan* (*Terminalia tomentosa*), *kanyin* (*Dipterocarpus* sp.), *thitya* (*Shorea obtusa*), *ingyin* (*Pentacme suavis*), *pyinma* (*Lagerstræmia Flos-Reginæ*), *didu* (*Bombax insigne*), and also some *zinbyun* (*Dillenia pentagyna*), *thingan* (*Hopea odorata*), *thitka* (*Pentace burmanica*), *petwun* (*Berrya Ammonilla*), *chinyok* (*Garuga pinnata*), *nabe* (*Odina Wodier*), *panga* (*Terminalia Chebula*), *lein* (*Terminalia pyrifolia*), *yon* (*Anogeissus acuminata*), *bambwe* (*Careya arborea*), *myaukchaw* (*Homalium tomentosum*), *binga* (*Stephegyne diversifolia*), *thitpayaug* (*Nauclea excelsa*(?)), *mayaukng* (*Daubanga sonneratioides*), *hnaw* (*Adina cordifolia*), *yamane* (*Gmelina arborea*), *pinlekanazo* (*Heritiera* sp.), *kokhe* (*Bombax* sp.).

The bamboos sent have been principally *myinwa* (*Dendrocalamus strictus*) and *kyakatwa* (*Bambusa arundinacea*).

In has also formed a large part of the total of railway sleepers sent, other important woods were *pyinkado*, *taukkyan*, *pyinma*, *ingyin*, smaller quantities of other hard woods being included.

All important species have been given serial numbers with the letter B, so that they may be marked in the forest or at the mill and identified and reported on after being in use."

Rodger gives the following summary of the position in 1919 :

(1) During the year ending June 30th, 1919, a large quantity of timber was shipped before the Armistice. After November most of the important indents for Basra and Egypt were cancelled, and since then the quantity shipped has not been large.

(2) Large stocks of timber, sleepers and bamboos are held in Burma, and it is proposed to dispose of them gradually.

(3) A full Report on the method of work was printed as an appendix to the Annual Report for 1917-18.

(4) In the following table are shown the quantities shipped up to June 30th, 1919 :

STATEMENT SHOWING QUANTITY OF TIMBER DESPATCHED OVERSEAS FROM BURMA BY THE FOREST DEPARTMENT AND MUNITIONS BOARD FROM 13TH APRIL, 1917, TO 30TH JUNE, 1919, IN CUBIC TONS :

Country. (1)	Teak.		Other Wood.		Bamboos.		Sleepers.		Tons. (10)
	Tons. Round (2)	Sawn (3)	Tons. Round (4)	Sawn (5)	No. (6)	Tons. (7)	No. (8)	Tons. (9)	
Mesopotamia . .	1,166	15,787	720	17,263	144,844	3,385	542,826	21,749	60,070
Egypt . .	303	238	4	11,710	75,200	752	401,086	17,168	30,175
Salonika . .	—	—	—	10,468	—	—	—	—	10,468
East Africa . .	—	158	—	—	—	—	—	—	158
Aden . .	—	—	—	—	—	—	16,080	486	486
India . .	34	8,744	571	1,037	—	—	603,650	36,661	47,047
Total . .	1,503	24,927	1,295	40,478	220,044	4,137	1,563,642	76,064	148,404
Deduct total despatched to 30th June, 1918 . .	834	13,015	404	29,123	128,490	1,424	546,977	27,451	72,251
Balance being timber despatched from 1st July, 1918, to 30th June, 1919 . .	669	11,912	891	11,355	91,554	2,713	1,016,665	48,613	76,153

In connection with the work carried out by the officers in the forests the following extract from the Report of Mr. C. B. Smales, Conservator, Pegu Circle, is of high interest :

“ The meeting of indents for timber for military requirements has entailed a good deal of extra hard work upon many of the staff. Much of the actual sawing is done by mills along the railway line, but the selection of the trees, the arrangements for extraction of the logs and their check into the mills, the measurement and selection of the results of sawing and the despatch to Rangoon, has necessarily absorbed much time and trouble. Departmental sawing and the hewing of squares is also done to supplement the outturn of the mills and such special orders, for instance, as the indent on Tharrawaddy for squares 45 feet long and planks 50 feet by 16 inches required special arrangements. The finance of all this has represented an expenditure of over 8 lakhs and the keeping of detailed accounts has increased the work of the clerical staff, especially in Tharrawaddy and Zigon Divisions. Divisional Officers all commend the willing work of their depot staffs upon whom has fallen the task of passing, measuring and despatching all the timber. . . . Mention should also be made of

the good work done by the Manager of the Minhla Sawmill (Tharrawaddy District). Since February his mill has been working night and day, and has supplied the majority of scantlings and sleepers supplied from this Division. He has a good command of labour and dragging power, and made excellent arrangements for the supply of timber to his mill. This year a much greater demand has been made for railway sleepers than before. The first arrangement made by the Munitions Board was that railway assistants should inspect and pass all sleepers and receive a fee of 1 anna for each sleeper so passed. This was felt by Forest Officers to be rather unnecessary, and it was also considered that the smaller contractors would have more confidence in working if an officer with whom they made their contracts also took over their sleepers and could correct their faults. Therefore, Mr. Blanford started passing sleepers himself, of course without fee, and other officers followed the example. Latterly, Mr. Pinder has helped Mr. Blanford, but the majority of the 71,085 sleepers have been passed by the Divisional Officer himself, no small achievement in a very heavy Division. The species indented upon for supplies have been very largely *pyinkado*, *kanyin* and *taukkyan*, but *In*, *panga*, *pyinama*, amongst hardwoods, and *taungletkok*, *hnaw*, *didu* and *letpan* as softwood were also extracted, besides a few miscellaneous species. Indents latterly tend to specify the actual species desired, so that the variety of woods first extracted can no longer be tried so easily. Mr. Blanford notes: '*Taukkyan* splits very badly and appears to be full of defects. It was found, however, that sleepers cut from logs that had been seasoned in the round for a year were much freer from splitting, but that there was much splitting even in the round. Girdling of *taukkyan* a year before it is required would no doubt greatly improve this timber which, except for splitting, appears to be extremely suitable for sleepers or structural work. Sleepers cut from *pyinkado* and *kanyin* which had been felled for over a year show that the sapwood becomes rapidly soft and rotten. The heartwood of both species is still quite good.'

The following Officers were mentioned for the Forest work :
 I.F.S.—Messrs. H. W. A. Watson, H. L. P. Walsh, H. R. Blanford, L. C. Davis, N. V. Holberton, A. W. Moodie. Prov. F.S.—R. M. Kavanagh, F. Ryan, R. R. O'Hara, P. E. Plunkett, B. P. Kelly, W. I. G. Cooper, Hatim Tai, C. C. Chill, G. F. Mathews and Maung Po Thin.

PUNJAB

Mr. W. Mayes, at the time Conservator, Western Circle, Punjab, wrote an account in 1919 of the War work carried out in the Punjab, which is reproduced here in part :

" Out of the small total of nine Imperial Service Officers in the Province, who were qualified by age for entry into the Indian Army Reserve of Officers, three, viz. : Messrs. R. N. Parker, M. R. K. Jerram and E. A. Greswell, received commissions. Mr. Parker was employed as Assistant Controller of Contracts for the purchase of firewood for the Army. Mr. Jerram served with the 2nd Gurkha Rifles in France and Mesopotamia, and was awarded the Military Cross for distinguished service. Mr. Greswell was employed under the Munitions Board as Deputy Controller of Timber Supplies for the Punjab. The removal of these three officers from a staff, already too small for the needs of the Province, involved a great increase of work and strain on those who remained behind to cope with the great and urgent demands made on the Department for war material in the shape of timber, firewood, bamboos, turpentine and rosin. That the Department was not unsuccessful in meeting these demands will appear from the following details : The outbreak of war found the forests of the principal timber-producing Divisions—Bashahr, Kulu and Rawalpindi—for the most part leased to contractors on leases which ran to the 31st March, 1920, in the case of Kulu and Rawalpindi. For the first three years of the War the contractors continued to work under their leases, and to sell the timber they extracted to the Military Authorities. In the middle of 1917 the demand for timber became insistent, and to cope with it departmental extraction of timber was commenced in the early autumn of 1917 in Bashahr and Rawalpindi. This work met with great difficulties at the outset. Labour and supplies were difficult to obtain. No departmental work had ever been done in Rawalpindi before, and none in Bashahr for many years : the staff was consequently inexperienced as well as inadequate. In spite of difficulties a start was made in September, 1917 ; and it was arranged that the Bashahr Division should supply to the Munitions Board by the 31st March, 1920, 30,000 tons of deodar, blue pine, *chil* (*Pinus longifolia*) and fir timber. When hostilities ceased in November, 1918, 22,000 tons out of the 30,000 tons had been cut in the forests, and over 9000 tons had

been launched into the river ; so that there was every probability that the agreement made by the Department would have been carried out. Considering that a beginning had to be made from absolutely nothing, and that practically all the labour and supplies had to be imported, the work done is no small credit to the officers concerned. The actual delivery of the timber to the Munitions Board was, unfortunately, greatly hampered by the failure of the monsoon rains in 1918. The supply of water in the upper streams was so small that the timber could not be floated down ; with the result that on the termination of hostilities only 400 tons had actually been delivered to the Board ; and as the remainder was no longer wanted for military purposes it was released for sale in the open market. The large stock of timber on its way from Bashahr played a very useful part, in that it gave the Munitions Board a reserve on which it could fall back, and enabled it to control the timber market and to obtain supplies of timber at reasonable rates ; with the result that when hostilities ceased the Board found itself with only small commitments for advance purchase. Simultaneously with the starting of departmental exploitation in Bashahr similar work was started in Rawalpindi Division for the extraction of *chil* timber, and was continued in both the Rawalpindi East and West Divisions into which the old Rawalpindi Division was divided from the 1st October, 1917. Here also difficulties of every kind were encountered. The labour difficulty, which is more or less chronic throughout the Punjab, was here aggravated by the fact that the greater part of the able-bodied population of the Rawalpindi District had joined the Army. The transport question was even more serious. Most of the timber from the Rawalpindi Forests has to be carried to the railway by road, and the only means by which it can be got from the forests to the main roads is by camels. As most of the camels in the district had already been taken for military purposes the difficulties of transport will be realized. A certain amount of help was obtained from time to time from the Military Camel Corps, but these, being always held ready for active service, could never be counted upon with certainty. However, thanks to the efforts of the Divisional Officers and their staffs, the difficulties were surmounted, and a quantity of some 2400 tons of sawn *chil* timber and 3000 *ballis* (poles) was delivered to the Munitions Board up to the conclusion of hostilities. A considerable further stock including some

34,000 *ballis* was ready for delivery but was no longer required. Incidentally it may be mentioned that this Rawalpindi timber was much appreciated by the Military Authorities, being of selected quality, finely sawn, true to dimensions and with square ends and edges such as are not found in river-borne timber. Further, it was supplied at a rate well below the market rate.

In the Simla Division arrangements were made for the supply of railway sleepers to the Munitions Board from the Simla Municipal and Catchment Area Forests. The work was not done departmentally, but by Messrs. Sultan Singh and Co., contractors, under the superintendence of the Divisional Forest Officer. The total number of deodar and *chil* sleepers supplied was 53,523. The contractors carried out the work very well, and at practically no profit to themselves. In Kangra departmental extraction of *chil* timber was started in the autumn of 1917. The forests of this division contain little really good timber, but by the end of March, 1918, some 250 tons had been prepared. However, by the time it reached depot the Armistice had been signed and the timber was no longer required. In Lahore Division 1200 tons of *shisham* timber were supplied to the Military Authorities from Changa Manga Plantation.

In the winter of 1917-18 the demand for timber for aeroplane construction became urgent. An expert officer of the Munitions Board visited the spruce and silver fir forests in Bashahr to test the timber. It was eventually decided to obtain the necessary supplies from other sources, as the spruce and silver fir were found to be not exceptionally well suited for the purpose, while the difficulties of extraction were very great. A number of scantlings of walnut were also cut for experiments in the manufacture of propeller blades. It was found, however, that the Himalayan walnut, when cut green, developed a tendency to split which made it unsuitable for such work. Experiments in girdling and seasoning were started, but no definite results had been obtained when hostilities came to an end.

The Lahore Division supplied some 4600 tons of firewood direct to the Military Authorities, partly from Changa Manga and partly from forests in the Montgomery District. Rawalpindi West Division supplied 15,000 tons, and could have supplied much more had it not been for the serious transport difficulties to which allusion has already been made. In

addition to these items a very large but unknown quantity of firewood from the Government Forests reached the Military Department through contractors, who bought the trees standing and converted them into firewood. In the autumn of 1918 departmental fellings were started in Multan Division, and some 3200 tons of firewood were prepared, but owing to the Armistice were not required by the Military Department. An equal quantity was prepared in the Montgomery Forests of the Lahore Division, but was not required. The only Divisions in the Province which produce bamboos in commercial quantities are Kangra and Hoshiarpur. It was the previous custom to sell the bamboos standing, but in the winter of 1917-18 departmental fellings were started, with the result that the yield for that year amounted to 1,168,000 as compared with 557,750, the average of the previous five years. The outturn was thus doubled to meet the urgent demands of the Military Department for war purposes. Most of these bamboos were supplied to the Military Department through middlemen, but some 50,000 specially cut to specification were supplied direct by the Department. In September, 1918, it was decided to undertake the departmental manufacture of tent-poles and lance-staves, and indents were accepted from the Munitions Board for 120,000 tent-poles and 2000 lance-staves, as well as indents for 230,000 bamboos for hutting purposes from the Military Works Service. All arrangements had been made to carry out these indents, when the cessation of hostilities led to the cancellation of those for tent-poles and hutting bamboos. The supply of lance-staves, however, was continued, and up to the end of March, 1919, about 1400 had been supplied. These staves are required to be of very special quality, and accordingly have to be very carefully selected.

The Jallo Factory supplied just over 17,000 gallons of turpentine and 200 tons of rosin to the Military Department during the period of the War. Some 40,000 gallons of turpentine were supplied to Indian Railways during the same period. An indent for 250 tons of rosin placed by the Ordnance Department in the autumn of 1918 was cancelled on the termination of hostilities."

The following officers, including Mayes himself, were mentioned for their services: Messrs. A. J. Gibson, H. M. Glover, H. L. Wright, Deputy Conservators; Mian Budhi Singh and Malik Allah Yar Khan, Extra Assistant Conservators, and Lala Ram Chandra, Babu Bahadur Singh, Munshi

Fateh Muhammad, Ch. Muhammad Azim, Munshi Muhammad Shafi and Munshi Karim Bakhsh, Forest Rangers.

The Indian Munitions Board issued special letters thanking the officers and subordinates of the Department for the valuable work carried out and asked that "this expression of the Board's appreciation of the services rendered may be communicated to the officers and subordinates concerned." A paragraph of the letter transmitted to the Punjab and to the other Provinces reads as follows: "I am to say that the Board realizes that compliance with the Military demands transmitted through this office, and in many cases, on account of unexpected changes in the War fields, the sudden cancellation of such demands, has often caused great inconvenience and difficulty, has imposed a heavy strain on some officers and added considerably to the work of many others; and I am to acknowledge the ungrudging spirit in which this exceptional service has been rendered with the sole desire of helping in the prosecution of the War."

UNITED PROVINCES

It will be shown in a later chapter that the United Provinces were heavily indented upon for timber and other forest produce during the War, both for the requirements of the Armies and also for India itself. Clutterbuck, Collier, and others, were responsible for good work. The Sawmill at Sitapur was kept hard at work. An outcome of this great demand was the erection of the factories at Clutterbuckganj, which will be described later. One of the demands of the Military Authorities was for forage. An immense amount of animal transport was employed on the lines of communication on the Eastern fronts and the forage problem soon became urgent. The three Provinces mainly concerned, together with many Indian States, were the United Provinces, Central Provinces and Bombay.

A special Hay Division was inaugurated in the United Provinces, to the charge of which Mr. J. F. R. Channer, Deputy Conservator of Forests, was appointed. He was assisted by the following officers: Messrs. A. Monro, I.C.S., and A. A. Waugh, I.C.S., Assistant Commissioners, and a considerable and able Indian Staff.

In a Report on the work for the season 1917-18 (Govt. Press, U.P., Allahabad, 1918) Channer gives the following abstract of the operations undertaken:

" The Special United Provinces Hay Division was instituted from the 4th September, 1917, at Jhansi, the Headquarters of the Division. Its object was the supply of 50,000 tons of fully-pressed hay to the Director of Grass Farms, this being the contribution of the Government of the United Provinces to the requirements of the Quartermaster-General in India for the expeditionary forces in Mesopotamia, Egypt, Palestine and Salonika.

A few remarks on the size of the operations will not be out of place, since the enormous bulk of hay in comparison to its weight constitutes the chief difficulty, involving as it does a strong tendency on the part of all concerned to overestimate the weight of the crop on any given area and the capacity of the available organization to handle it. Fifty thousand tons of fully-baled hay require about 7000 broad-gauge wagons, making a train thirty-three miles long.

About 54,000 tons of half-baled hay are required which, if railed to cotton presses, require about 20,000 wagons.

About 60,000 tons of hay must be cut, requiring about 5,400 cutters and 1600 carts every day for five months. Fifty-four thousand tons of loose hay if very well pressed down would form a stack of 45,000,000 cubic feet. An extra large size of stack might be 50 feet broad, 40 feet high in the centre, and 20 feet at the sides—such a stack would be five miles long.

The hay supply was as follows :

Supplier.	Hay arr'ng'd for.	Delivered.					Paid for at various stages.	Out- turn of press.	Un- pressed.	Total hay.
		At depots for railing to press.	At press.		Total.	Re- ceived at presses.				
			Loose.	Half baled.						
U.P. Forest Department Native States of Central India	25,470	1,562	7,607	8,981	18,150	18,090	17,556	15,645	800	16,445
	51,630	20,059	15,506	2,515	38,080	37,983	37,405	34,331	1,224	35,555
	77,100	21,621	23,113	11,496	56,230	56,073	54,961	49,976	2,024	52,000

Average distance hay was carted to rail = 12 miles.

Average distance hay was railed to presses = 90 miles.

Average distance hay was railed to Bombay = 660 miles.

Hay was pressed at a cost of Rs.14 per ton at twenty-five pressing depots, at fifteen of which nineteen cotton presses were used and at eleven of which twenty-one portable 1-maund

bale presses were used. Two-thirds of the outturn was from cotton presses. The cost of the operations was as follows :

	Rs.	a.	p.
Cost of hay (excluding railway freight, establishment and contingencies) per ton delivered at depots before pressing	19	3	0
Cost of hay when fully baled (excluding establishment and contingencies) per ton	49	0	0
Total cost free on rail per ton	52	0	0
Cost on arrival at Bombay per ton	76	11	0

The hay is accounted for as follows :

Burnt before despatch	257 tons.
Despatched	45,780 „
Baled hay stored locally	3,939 „
Unbaled hay stored locally	2,024 „
Total	<u>52,000 „</u>

The importance of the work of the Department and the very satisfactory output during 1917-18 will appear from the following figures supplied by Mr. P. H. Clutterbuck, Chief Conservator of Forests, United Provinces :

“ In modern warfare timber is a most important factor : and the supply of timber is naturally the most important work of the Department. During 1917-18, 750,000 sleepers for metre-gauge railways, and 150,000 sleepers for broad-gauge railways, were supplied, valued at Rs.22,90,000, as well as 8000 tons of beams, scantlings and planks for buildings, bridges, and other military purposes. Altogether over 2 million cubic feet of timber were delivered, and the value exceeded Rs.28,00,000.

Next in importance was the supply of hay for the Armies overseas. The United Provinces was asked to supply 50,000 tons (1,360,000 maunds). Actually 52,000 tons were arranged for at a cost of 21 lakhs of rupees.

Tan stuffs, so essential for the manufacture of boots and all leather goods supplied to the Army Department, formed another important item—and 25,000 maunds were collected. In addition, the cultivation of *tarwad*—an important tanning agent—has now been started on a large scale.

Last, but not least, was the supply of rosin from turpentine. Owing to the great reduction in imports during the War, the

Indian Empire is now to a large extent dependent on the Forest Department for these valuable commodities.

Railway companies require large quantities of these articles : so that indirectly in this way, and also by releasing the ships that would be required for importing them, the manufacture of rosin and turpentine is of no small importance as War work.

The Bhowali Factory turned out 42,000 maunds of rosin, valued at Rs.7,00,000, and 90,000 gallons of turpentine, valued at Rs.3,30,000.

The total value of supplies for War purposes, direct and indirect, during the year was Rs.60,00,000. This figure gives some idea of the important assistance to the War rendered by the United Provinces Forest Department."

CENTRAL PROVINCES

The Central Provinces were also requested to supply fodder grass for the Armies. Sir H. A. Farrington, Chief Conservator, has kindly given the following summary from Mr. Narsingh Rao's " Report on Grass Operations connected with the Supply to the Army Department during the years 1917-20 from the Central Provinces and Berar." The summary is as follows :

" January, 1917.—Undertaking given to supply 20,000 tons fodder grass from the three Circles. The Forest Department to do the cutting, hand-baling, carting, loading on rail and dispatch while the Civil Authorities undertook the hydraulic baling.

August, 1917.—Indents increased to 40,000 tons.

September, 1917.—Indents increased to 80,000 tons.

Year 1918-19.—96,000 tons asked for.

Year 1919-20.—25,000 tons were to be supplied.

Actual figures of supply from these Provinces by the Forest Department were : 1916-17, 18,160 tons ; 1917-18, 93,498 tons ; 1918-19, 62,024 tons ; 1919-20, 17,073 tons.

The work was severely handicapped in 1917 by the late intimation received at a time when purchasers had removed the best of the grass, and when no organization existed for departmental work ; in 1918 by scarcity and a poor grass crop, in 1919 by difficulties on account of the influenza epidemic which carried off nearly 40 per cent of the labouring population, shortage of food stuffs, unseasonal rain and scanty monsoon, and the local demand arising from scarcity,

particularly in Berar. In 1919-20 the Military Department became very exacting and rejected a large quantity of a kind they had gladly accepted in the previous years—in the Southern Circle 1797 tons were thus rejected.

The rates paid for cutting varied between 8 annas and Rs.3 12 annas per thousand *pullas*, *pullas* weighing from $\frac{1}{2}$ to up to $1\frac{1}{2}$ lbs. Carting rates per thousand *pullas* per mile similarly showed a variation of from 2 annas to 6 annas. The rates rose as the operations proceeded, when the people began to realize that Government must have the grass. The drying of the grass in the forest, the cleaning of it in the depots and the baling were all done on piecework on rates varying in different Divisions. Ninety per cent of the cutting was done by women, and there was always much trouble in attracting labour for this work. Daily labour was employed at from 2 annas per woman and 3 annas per man to 3 annas per woman and 6 annas per man per diem for drying, and redrying and stacking and restacking when the grass became constantly wet from unseasonal rains; also for cleaning and fencing depots, preparing sheds, counting grass coming to depots, etc. The average number of *pullas* per ton varied from Circle to Circle, Division to Division, and even from Range to Range, in a most extraordinary fashion.

Fire protection was most successful in the forests themselves, and the amount burnt in depots was very small compared with the total outturn. Work at night in baling depots necessitated the use of many lights and accidents were inevitable.

Final Results.—Of 230,913 tons of grass indented for, 204,008 tons were cut and 187,649 tons of grass were delivered to the Military Department at a total cost of Rs.40,23,569, exclusive of the cost of steam baling and railway freight for transporting hand-pressed bales from baling depot to the steam press centres, also exclusive of the cost of baling wire; figures for the items above excluded are not at our disposal; 18,361 tons were rejected and Rs.1,12,790 realized thereon by sale elsewhere. Stores valued at 2 lacs of rupees remained on hand at the close of the operations, such as hay presses, tools, etc."

Timber was also supplied to the Munitions Board from the Singbhum Division, in the Province of Bihar and Orissa.

BOMBAY PRESIDENCY

The fodder grass operations carried out by the Department in the Bombay Presidency were associated with a number of Indian States and were carried through with conspicuous success in spite of the very considerable difficulties attending their initiation and maintenance. Mr. Edie, Chief Conservator, has kindly given the following account of the work, which depicts in a vivid manner the onerous nature of the task and the patriotic spirit in which it was carried through. Edie wrote :

" The first intention was that the Army indent of 10,000 tons = 224 lakhs lbs. to be supplied by the end of May, 1918, should be met from the Thana District, more especially from areas along the G.I.P. Railway, but the impossibility of supplying from there other than hand-pressed bales, which would, at immense labour, have had to be carried by the Army across Bombay and repressed by them in cotton presses, quickly caused the idea to be abandoned, and Khandesh was selected instead as the supply area. There were many advantages in the change. In Khandesh, Government had in the person of its famine fodder contractor, an agency for the collection and pressing of grass, and it was hoped that working through such agency would cause less dislocation of ordinary forest work than elsewhere. Then, at Nawapur and Chinchpada, the contractor had his hydraulic presses, and it was thought, though later events proved the contrary, that they would be able to turn out direct bales of the size and density required by the Army. Finally, the same contractor was working independently for the Army, was in close touch with all their arrangements for baling wire, for transport of the grass by rail and of storage of the bales in Bombay, and was in a position to relieve the Forest Department of an immense amount of petty detail and correspondence. The selection of Khandesh was certainly justified in the end, though matters by no means went so smoothly as was anticipated.

The first arrangement made with the contractor was that the Forest Department should employ its resources in assisting him with the cutting and collection of 150 lakhs lbs. at Nawapur and Chinchpada, and that he would press the same in his hydraulic presses, in bales of the requisite size and density ; the balance of 74 lakhs he undertook to supply

in cotton-pressed bales at Vyara on the T.V. Railway in the Surat District. The hydraulic presses, however, failed at once, the cylinders bursting under the increased pressure required, and the Vyara cotton press also failing to fulfil expectations, it became necessary to recast the whole arrangement. The situation was one of some anxiety, but by either hiring or purchasing cotton presses at places so far from the source of grass supply as Dondaicha and Nandurbar to the east, and Surat to the west, and by railing grass to those places either in hand-pressed or in low pressure by hydraulic-pressed bales, and then repressing them, or else by purchasing grass so far afield as Dabhoi in the Baroda State and cotton-pressing it there, the 10,000 tons were supplied in full between November and end of May. The breakdown of the original arrangements, of course, added immensely to everyone's labour, for it meant that instead of the bulk of the grass merely having to be brought to the hydraulic presses, baled and despatched, it had to be lightly baled, loaded, railed to the cotton presses, unloaded, rebaled and again loaded, and all this in the face of such difficulties as shortage of labour, of railway wagons and of severe plague at various points of working. Without the contractor's organization the work could never have been carried through; the whole arrangement for the hiring of the cotton presses, transport by rail, supply of wire and innumerable other details was in his hands. It is obvious that the Forest Department could not by its own agency have undertaken such a work as hiring cotton presses at distant places, arranging for their coal supply, and keeping up a staff for the receipt and unloading and carting of the grass, and the subsequent pressing, carting and despatching.

The work of the Forest Department consisted in arranging for the cutting of the grass, and this was considerably hampered at first by the heavy rain in the autumn of 1917; for its carting either to forest or railway station depots, for labour to work the hand presses which had to be employed in large numbers when the hydraulic presses failed, for carting to rail of bales pressed in forest depots and for labour for loading and unloading. It also had to keep Foresters at the cotton presses at Surat, Dondaicha and Nandurbar to supervise the pressing and to prepare and forward despatch notes and way-bills to Bombay. All this entailed heavy labour; in fact the Sub-divisional Officer, West Khandesh, and practically the whole establishment in the Nandurbar and Nawapur Ranges, and

also men drafted from other Divisions and Ranges, were engaged from November to May entirely on grass work to the perforced neglect of their proper forest duties. It will be seen that their task was no light one when it is mentioned that some 235 lakhs lbs. of grass were collected by them, and this quantity, if only handled once by cart, would represent at least 75,000 cart-loads; as a matter of fact, much of the quantity was handled twice, first as loose grass, then as hand-pressed bales. In the end the Army supply was made good by the despatch on May 29th of the final bale of the total of 91,057 bales of 246 lbs. each, required to make up 10,000 tons. The bales were pressed at the following places: Surat, 32,934; Dondaicha, 27,010; Nandurbar, 16,919; Dabhoi, 14,194. Although the Forest Department collected in Khandesh more than 10,000 tons, by no means the whole of it went to the Army in the shape of Forest Department bales; it has been mentioned that the contractor was working independently for the Army as well as for the Forest Department, and as time was of the greatest importance and it was imperative that his cotton presses should never be idle for a moment for want of grass, on whosoever account they were working; he was allowed to use indiscriminately either for his Army or his Forest Department contract whatever grass was ready to hand, the sole stipulation being that whatever quantity of forest grass he used for his private contract he should make good to the Forest Department from elsewhere. Thus none of the Dabhoi bales were of forest grass, nor a good number of the Surat ones. The arrangement was to the advantage of both parties and worked out well; it was of course, and more important, to the advantage of the Army, to whom continuous supply from one or the other source was assured."

Grass supply was only one side of the work carried out. As Edie has shown, all expenditure was curtailed and only such projects as were likely to be useful for the execution of Munitions Board indents were allowed to be undertaken. The Alnawar-Dandeli Railway was constructed as a result of that policy.

In 1916-17 extraordinary fellings were made in the most suitable areas of the Kanara West and Belgaum Divisions for supplying the following material to the Munitions Department, Bombay, for war purposes:

Junglewood poles, 21,131 (No.); Do. logs, 9593 cubic feet.

Mango planks, 4620 running feet. Bamboos of sorts, 201,150 (No.). In 1917-18 the following produce was supplied to the Munitions : Teak logs, 128,534 cubic feet ; poles, 19,787 (No.) ; scantlings, 10,050 cubic feet ; battens, 100,000 running feet. Junglewood logs, 83,187 cubic feet ; poles, 74,199 (No.) ; scantlings, 471 cubic feet. Fuel, 8493 tons of 100 cubic feet each. Bamboos, 1,374,700 (No.) of different sorts. Tarwad bark, 76 tons from Dharwar-Bijapur ; hirda, 75 khandies from E.D. Kanara (khandi = 560 lbs.).

During 1918-19 the following material was supplied to the Munitions : Teak logs, 19,853 cubic feet ; poles, 888 (No.) ; scantlings, 557 cubic feet ; battens, 138,888 running feet. Junglewood logs, 76,825 cubic feet ; poles, 100,730 (No.) ; scantlings, 3,152 cubic feet ; battens, 363 cubic feet. Fuel 294,609 cubic feet. Bamboos, 53,243 (No.). Tent pegs, 5220 (No.). Tarwad bark, 14 tons and 13 maunds.

The following officers volunteered for War Service :

Messrs. G. P. Millett, J. D. Maitland-Kirwan, D. R. S. Bourke, J. B. Brooks, R. P. Dalley, R. W. Inder, W. C. Milne, D. B. Sothers. Mr. W. C. Milne died of enteric fever in Baghdad. Four officers, Messrs. E. M. Hodgson, H. L. Newman, P. E. Aitchison and R. W. Inder, served under the Munitions Board.

MADRAS

The Madras Presidency provided both timber, fodder and tannin materials during the War. Mr. T. Clear, I.F.S., at the time a lieutenant in the I.A.R.O., was in charge of the fodder supply, and Messrs. A. W. Lushington and P. W. Lushington, I.F.S., were employed in connection with the other supplies for the Munitions Board. The following record is based upon a Report on this work by Mr. S. Cox, late Chief Conservator.

Timber-Teak.—5726 cubic feet of teak from South Malabar and 17,397 cubic feet from South Coimbatore were supplied to the Munitions Board, mainly for ship-building purposes. A further quantity of 8524 cubic feet of selected teak from Nilambur was supplied to Messrs. George Brunton & Co., Ltd., of Cochin, at concession rates, for the construction of their ship of 1500 tons. Further large quantities of teak were also sold for building native craft to replace the coasting steamers.

A century earlier the Government Officers were obtaining teak from Malabar for exactly similar purposes, as a reference to Chapter VI, in Vol. I, will readily show. Half a century's

work by the Department had made this historical parallel a possibility.

Of miscellaneous timbers 7293 cubic feet from North Malabar and 19,171 cubic feet from South Coimbatore were supplied for the construction of piles, bridges and landing stages in Mesopotamia. 2062 cubic feet of *Grewia tiliæfolia* logs were supplied to the Buckingham and Carnatic Mills Co., Ltd., for the manufacture of tent poles for military use. In the latter part of 1918 the Munitions Board asked for the supply of *Poonspar* and *Aini* timbers for aircraft construction. The work was put in hand and a certain quantity of timber cut, but the Armistice rendered the supply unnecessary. Irregularity in supplying wagons was said to have contributed to the delay in meeting the demands of the Military Department—but Madras were not alone in this world-wide War trouble.

Burma teak having been commandeered by Government, a demand arose for sâl timber, and requisitions were made on the Gumsur sâl forests (cf. II, p. 115) in Ganjam for broad- and narrow-gauge sleepers, sâl scantlings, and other building materials, and bamboos. Considerable amounts of tan stuffs were collected in the forests of the following kinds: *Cassia auriculata*, 44,694 candies (1 candy=500 lbs.); *Anogeissus latifolia* bark, 10,655 candies; *A. latifolia* leaf (sumac), 1258 candies; *Zizyphus xylopyra*, 297 candies, and *Acacia decurrens*, 13 candies; or about 57,000 candies in all.

As regards forage, about 5385 tons of hay were supplied between 1917-20, and 23,989 tons were removed directly by the Military Department between August, 1914, and June, 1919. The Department also undertook to supply 1500 tons during 1919-20. A considerable number of Forest Officers of subordinate rank were transferred to assist the work of the Military Grass Farms Department.

THE FOREST RESEARCH INSTITUTE

Captain H. Trotter, Economist, has kindly given the following résumé of some of the work done by the Economic Branch in connection with timbers required for special purposes during the Great War:

"I have been through most of the files that were accessible, but to get a complete record of the work done during this period would take a very long time. I fancy, however, that this list is more or less what Professor Stebbing

requires." Mr. R. S. Pearson, who was in charge of the branch during the period, has added some remarks to the list.

(1) Strength tests on the glue joints of the Surma Valley ply wood for air-craft purposes.

(2) Strength tests on various samples of glues submitted by the Director of Aeronautics.

(3) Strength tests on various Indian timbers for using in aeroplane construction. These tests covered some thirty species and represented about a year's continuous work.

(4) Investigation on various waste products for paper-making.

(5) An investigation of the oil from the seeds of *Aleurites cordata* at the request of the Indian Munitions Board.

(6) An investigation as to suitable substitutes for walnut for air-craft construction, propeller blades and rifle butts, at the request of the Indian Munitions Board. Pearson adds the following: "Item 6 covered a large series of tests at the Ishapore Rifle Factory. It may be noted that the result of this enquiry was that all rifle stocks made in India in the latter half of the War were made of Indian grown timber as against imported. A considerable amount of work in passing and selecting timber for air-craft work had to be carried out.

(7) Some experiments on the treatment of bamboos with hot oil to prevent insect attack at the request of the Indian Munitions Board.

(8) An enquiry into the amount of charcoal available for the troops in India.

(9) Modified seasoning experiments on some twenty-five Indian timbers carried out at the request of the Indian Munitions Board."

CHAPTER XX

THE PROGRESS MADE IN MODERN METHODS OF EXPLOITATION AND IN THE CONSTRUCTION OF COMMUNICATIONS AND BUILDINGS, 1901-25

THE various methods of exploitation in use in the forests have been discussed in previous chapters of this history. It has been shown that excessive damage and waste accompanied the native methods as also the unchecked fellings of the earlier British timber contractors. With the inauguration of the Forest Service departmental working came into force and persisted in many parts for far too long a period, at the expense of progress in silviculture and other professional operations. In Chapter XVI (Vol. II) the gradual evolution of exploitation methods was described. By the end of the century departmental working was the exception rather than the rule, timber trees being chiefly sold standing to the contractor, after selection by the Department, and worked out by the purchaser; other produce was sold on permit. But little progress had been made to place new species of timbers on the markets, the creosoted pine sleeper was still regarded as impracticable, new methods of extraction were viewed by superior officers with disfavour, the complacent attitude taken up being only too accurately portrayed by Ribbentrop in 1899 in the extract given on page 517 (Vol. II).

The work of the twentieth century has taught the present Indian Forester many things; but perhaps in no direction has it been of greater value than in displaying once for all in India the close connection between silviculture (and the Working Plan) and the exploitation of a forest area. Secondly, it has demonstrated the necessity of having an Exploitation Officer in charge of the work where the extraction of regulated and large amounts of timber from considerable tracts of forests is in question. Finally, a result to some extent the outcome of the demand during the War, of the practicability of obtaining

a sale for many species which were unsaleable towards the close of last century (II, 510). To a considerable extent, and for the purpose of demonstrating the value of the timbers of these accessory species, departmental working came back. But this departmental working was very different from the old. It was associated with the Forest Engineer and the employment of up-to-date equipment, as will be described ; moreover, in some cases it dealt with great areas of forest previously deemed inaccessible and unexploitable as, e.g. the evergreen forests in the Palghat in Madras, some of the teak areas in North Kanara and so forth. The full appreciation of the value of good adequately graded forest roads is also apparent in some Provinces, whilst the utility of the forest tramway is now thoroughly appreciated. Exploitation operations of considerable interest are being undertaken in various Provinces which will be referred to in this chapter, together with the progress in communications and buildings. The inauguration of the Utilization Circle and its rather chequered career in several Provinces will be reviewed, as also the present position of the Forest Engineer.

The thought may arise, perhaps, that the pendulum has swung back and that the Department has returned once again to departmental operations. But I think it will be realized that in some Provinces, at least, the recognition exists that the Exploitation Officer or Forest Engineer is essential and that all machinery and so forth required in connection with exploitation should be under his sole charge together with the staff necessary for its service and maintenance. More than ever nowadays it is necessary that the Divisional Officer should be free to devote himself to the requirements of the forests in his charge and that, above all, he should have the time, which is indispensable, to give to the silvicultural needs of the growing stock. The thorough recognition of the fact that exploitation without efficient silvicultural tending may result in diminishing the forest capital, is essential alike in the forest division as at the headquarters of the Government. It is an impossibility for the Divisional Officer to undertake both exploitation and the silvicultural improvement of his crop in areas of the size of many forest divisions in India. Modern exploitation demands the extraction of all species of *timbers* of any commercial value in the felling areas and not merely, as in the old days, of one or two species. It is this new position which has compelled departmental working of the forests in order to demonstrate

that financial success is possible. To this may be attributed the apparent swing of the pendulum. Half a century ago the infant Department undertook departmental working in order to put an end to the wasteful exploitation methods in force ; to-day it is carrying out schemes to demonstrate the possibility of working out mixed tropical or semi-tropical forests comprising many different species of timbers of a high technical value for which previously there was no market. This, perhaps, expresses the new position in the briefest manner. In order to make plain the great transformation, for it may be considered a transformation, which is taking place in the exploitation of the forests *qua* forests, as against the former practice, it has been deemed advisable to deal with the subject Province by Province, instancing only some of the most noteworthy of the new exploitation works. The problem has been to some extent complicated by the formation in some Provinces of the Utilization Circles, two of which have been (it may be hoped temporarily) discontinued. The Utilization Circle is so intimately connected with exploitation that though from one point of view it might be regarded as of sufficient importance to have merited a chapter to itself a careful marshalling of the facts rendered it evident that the review of its origin and development inevitably fell under exploitation.

The order in which the Provinces are dealt with under the heads here reviewed is that in which the writer visited them during his recent tour. It may be recorded that the development in exploitation in recent years, as this chapter will exhibit, is as remarkable as some of the other notable advances made by the Department during the present century, and it is all the more noteworthy since it is being correlated, as already indicated, with a close attention to the well-being of the future growing stock of the forest areas, whilst attempts are being made to place the financial part of the extraction work on a system of commercial accounting. The exploitation work carried out with difficulty during the War, owing to the want of technical engineering knowledge, machinery, etc., in the Department, led the Government of India to suggest the inauguration of a Forest Engineer Branch with a cadre of its own, to be attached to the Forest Department. The proposal was sanctioned by the Secretary of State, and seventeen probationers, mostly selected from men possessing a previous engineering training with service in the Royal Engineers during the War, were selected, as already detailed in a previous

chapter. The idea of bringing the Forest Engineer to the service of the Department was eminently sound, and it is the aim of this chapter to show some of the results which have ensued.

In various parts of this history allusion has been made to the requirements of the Railways in sleepers. The problem of supply by the Department had never been an easy one. In the absence of detailed enumerations of the growing stock it was impossible to say what the forests could supply. Communications were very poor and intensive Working Plans non-existent. Competition had to be faced from imports of sleepers from outside India, cut in forests the owners of which received little or no royalty on the wood, from materials cut in privately owned forests or in the Indian States, and so forth. The Railways and the Department did not always see eye to eye on the subject of price, as is evidenced by a perusal of the correspondence of 1901, 1902 (G. of I. Forests, A. Proc., No. 22, of May, 1903) between the Railway Authorities and the Inspector-General of Forests of that period. This correspondence led to the issue of Circ. No. 7, F., dated 20th May, 1903, from Government of India to the Forest Department, laying down the procedure to be adopted *vis-à-vis* the Railways and sleepers. As a result matters improved but little. In order to ascertain the position of affairs existing after the War, and as an outcome of a Conference on the subject, a Sleeper Enquiry Committee was appointed. The Committee consisted of Mr. F. W. Allum, officiating Chief Engineer, Indian State Railways, and Mr. R. N. Parker, now Forest Botanist, Forest Research Institute. Their Report was published in 1923-4. Briefly they recommended : (1) that the prices of wood sleepers in each area should be fixed from time to time in conference between the Forest Officers and the chief Railway Engineers. (2) That in case of forests belonging to the Government of India contracts for the supply of sleepers should be made direct with the Forest Department of each Province. As a result of further discussion between the Railway Board and the Inspector-General of Forests it was determined to appoint a whole-time Forest Officer whose pay would be charged to the Railway Budget and whose duties would be to investigate and obtain a complete knowledge of the possibilities of sleeper supply in the various areas of the sleeper pool, and further to help the Chief Engineers of Railways by advising them as to the best

methods they could employ for obtaining their requirements in wooden sleepers. Mr. R. G. Marriott, D.C. Forests, was selected and joined the appointment in May, 1925. A liaison officer of this kind should prove of great value. An interesting Report which appeared in February, 1925, is by Mr. H. G. Norman White, Indian State Railways, entitled "On certain indigenous Timbers of India, Burma and the Andamans considered suitable for Railway Carriage Building."

SOME MODERN METHODS OF EXPLOITATION

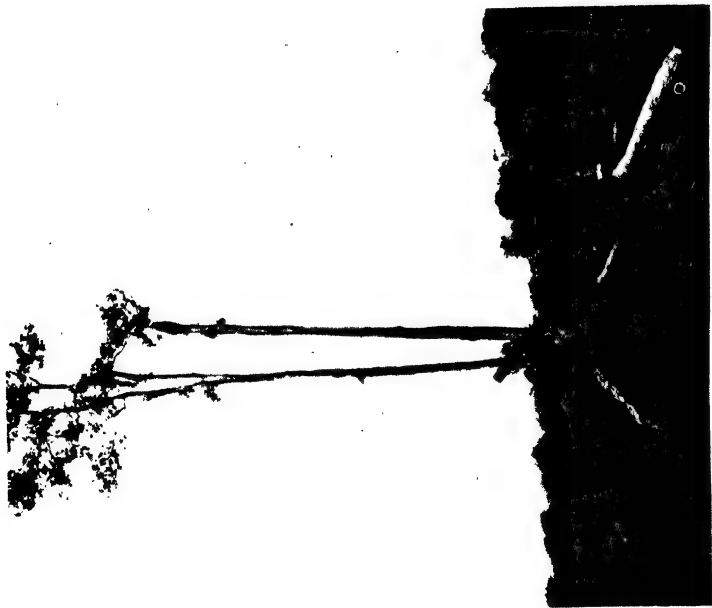
BENGAL

The ordinary methods of extraction of produce in Bengal, by water in the Sundarbans and Chittagong Divisions or by bullock cart or rail in the northern Divisions, have been already dealt with in previous chapters. A new departure has been made in the Kurseong Division. The silvicultural difficulties in obtaining regeneration in the Duars Sâl Forests have been already referred to. The obstacles in the Kurseong Division were increased by the absence of a labour supply. It became necessary, therefore, to introduce some form of mechanical extraction, and the credit pertaining to the solution of the problem belongs to the present Conservator, Shebbeare, and Houlding, the Forest Engineer. Regeneration by the *taungya* method necessitates Clear Felling. Both at Sukna, at the foot of the hills, and at Toong, at an elevation of 7000 feet, the logs are drawn to a centre by means of a skidder. In the first case they are then transported by railway (a branch line built by the Railway into the coupe) to the sawmill. In the second the skidder brings them to the mill, where conversion takes place, and the material is then sent down a thousand feet by a wire ropeway to the cart-road and railway below. The Sukna operations are described by Shebbeare and Houlding in the *Indian Forester*, December, 1923, January, 1924. They may be summarized as follows :

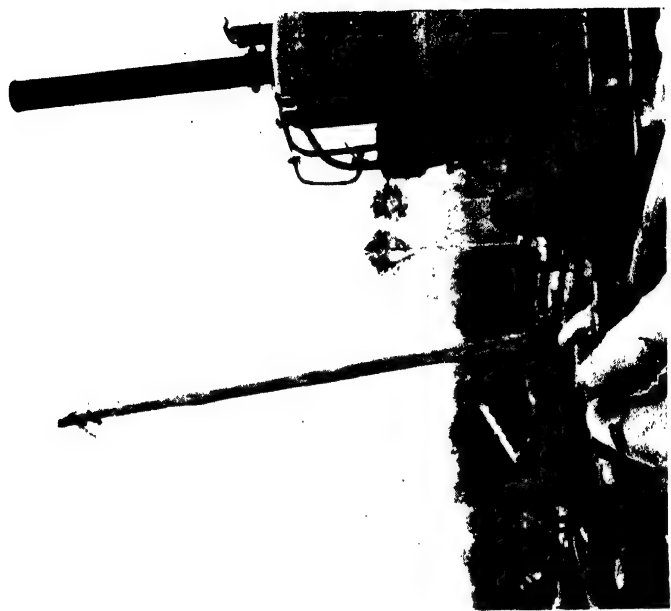
In order to keep a full-time staff employed, the softwoods, readily liable to insect and rot damage, are sawn up as soon as felled and converted into timber and planking during the cold-weather months—October to end of March ; the hardwood, sâl, not readily subject to decay and insect damage, is skidded in from the coupe to form a large dump at the railway siding during the cold weather ; in April and May the whole

of the labour force is turned on to the restocking work. In the rains proper, the skidder crew is employed in loading and despatching the sâl logs in railway cars, and the sawmill is used for sawing up these logs into timber and planking.

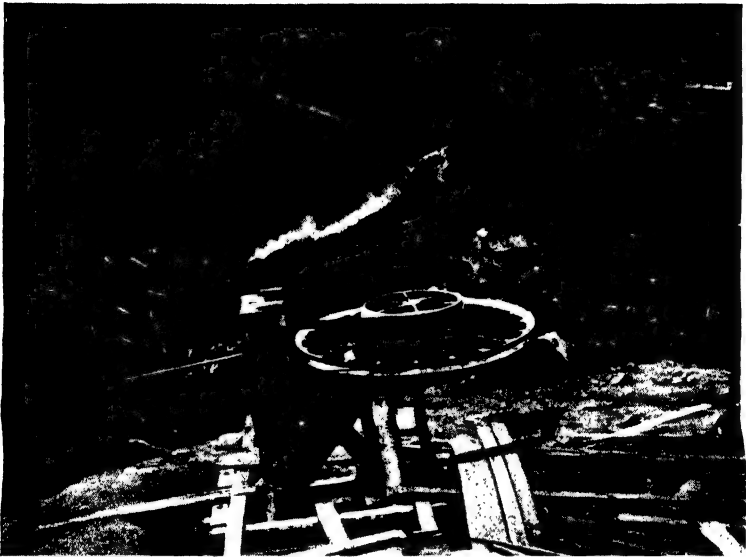
The extraction plant consists of a railway siding, a sawmill and a skidder. The siding runs from the main Darjeeling Himalayan Railway line at Sukna Station, extending in 1923 into the forest for a mile. This line was laid and maintained by the Railway Company *free of charge to the Forest Department* in consideration of the freights earned on the carriage of logs to Siliguri, a few miles distant, and the carriage of box planking and firewood to tea gardens, mostly situated on the hill section of the railway. The skidder hauls in the logs from the tree stumps to the railway line, where it loads them on to log cars specially built for this work. The ground is flat, so with a high lead of 70 feet skidding up to 1000 feet can be accomplished. The skidder has demonstrated the following. The uncertainty of the supply of bullock carts is overcome; a saving of from 1 to 1.5 annas per cubic foot if sâl is sent by rail compared with bullock-cart rates; much larger logs could be handled by machinery than was possible by hand and bullock cart, giving an enhanced value to the timber of from 8 to 12 annas per cubic foot. The small semi-portable sawmill, erected alongside the railway line, is of American manufacture with an English portable steam-engine. This could be obtained in Calcutta in 1923 for just under Rs.20,000 f.o.r., and it was said that once the labour staff had learned how to operate the various machines, very little skilled supervision was needed. On the subject of costs of sawing the authors say: "Hand sawing at Sukna is expensive and there would be an insufficient number of sawyers to convert the whole of the softwood felled each year into planking to give it its full market value. Owing to the high rates for hand-sawing, what soft wood is converted into planking yields no profit nor is the full royalty value of the timber realized by the Department. The sawmill converts the whole of the soft-wood timber felled each year in the coupes and not only enables the full royalty value of the timber to be realized, but also yields a profit of practically Rs.5 per 1000 square feet of planking sold as it is being run at present." The firewood, prepared from branches, tops and debris in the coupes, was sent in long open bogie cars, containing 830 cubic feet, to tea gardens mostly in the hill section of the railway round



CYR POLES WITH PULLEYS AND TACKLE EMPLOYED WITH
SKIDDER TO HAUL IN LOGS TO THE RAILWAY LINE AT SUKNA



THE SKIDDER LOADING LOGS AT SUKNA ON SPECIALLY
BUILT LOG CARS



THE WIRE ROPEWAY AT TOONG, WHICH IS GRAVITY OPERATED, HAS AN ENDLESS CABLE 7,000 FT. LONG RUNNING ROUND 7-FOOT DIAMETER SHEAVES AT THE UPPER AND LOWER STATIONS. THE UPPER STATION



THE WIRE ROPEWAY FROM TOONG SHOWING A TIMBER TRESTLE AND LOAD

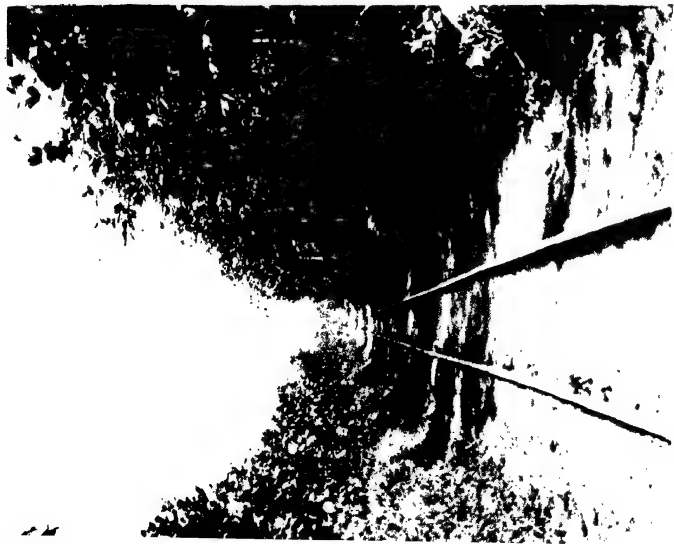
Kurseong. As with tea-box planking, the demand for firewood in 1923 was greater than the supplies available from the Sukna coupes. The following prices, realized per acre in 1923 from the different types of forest from (1) private contractors and (2) by departmental work, illustrate the value of the new departure: Sâl forest—fuel, (1) Rs.60.10.0, (2) Rs.97; box planking wood, (1) Rs.22.4.0, (2) Rs.29.8.0; sâl trees average from 3 feet to over 7 feet girth, (1) Rs.745, (2) Rs.1282.8.0 Soft wood forest—fuel, (1) Rs.36, (2) Rs.84; box planking wood, (1) Rs.33, (2) Rs.44; soft wood timber, (1) Rs.69, (2) Rs.128. The sâl (the largest revenue producer) was extracted by skidder and rail to a sale depot at Siliguri in the largest logs possible (32 feet); smaller sâl was sold as poles or as pieces for making ploughs, rice-pounders, etc. Almost all other pieces were sawn in the mill into $\frac{1}{2}$ -inch planking for tea-chests and the branchwood, etc., prepared as fuel. The comparison with departmental working and sale of standing trees (in both types of forest) worked out as follows: net profit per acre in the first case was Rs.128, in the second Rs.69.

The Forest Engineer states that the actual cost of extraction and despatching of timber from Sukna to the forest log depot at Siliguri by machinery and rail is slightly cheaper than bullock carts for the smaller sizes of logs, but from 1 to 3 annas per cubic foot cheaper for the larger sizes. In addition, the ability to handle large-diameter logs in 32-foot lengths enables much higher rates to be obtained for these logs than if they had to be cut into short lengths suitable for carriage by bullock carts. The saving by using mechanical means is roughly Rs.2500 alone per annum for a 40-acre coupe.

The Toong Operations which are being carried out up in the mountains are concerned with the exploitation of areas of forest much of which was previously unworkable though fellings were prescribed under the Working Plan. There are two Working Circles in this area under a long and short rotation, and Clear Felling is prescribed. The division between the short and long-rotation Circles is the old military road running for a long way as a 7000-foot contour between Kurseong and Ghoom, a few miles from Darjeeling. Advantage was taken of the existence of this road to start departmental mechanical extraction, conversion and transport operations in the cold weather of 1924, and what is believed to be one

of the most elevated, if not the highest, sawmills (erected at 7000 feet in the Himalaya) in the world came into existence. Some of the hands in the mill, when I visited it in February, 1925, consisted of porters who had been at the uppermost camps on the last Everest Expedition, of which Shebbeare (the Conservator) was himself a member. The Forest Engineer describes the operations as follows: "An American steam logging engine, with main and rehaul cables, set up at convenient places along the road, hauls logs up to the road from the 40-acre coupe laid out below the road, and also hauls logs down to the road from the 20-acre coupe of the long-rotation Circle above. The logging engine is mounted on a sledge and hauls itself from one position to another under its own steam. From the dumps made on the road by the logging engine, the logs are taken in bullock carts to the sawmills. A small tractor will in future be used for this haulage work. This work is done between November and May, before the rainy season sets in. In this very steep country it was found that little was to be gained from high lead logging as compared with the ground lead system. As the engine is frequently moved, the time taken in rigging up for high lead work is considerable, whilst good tree-stump anchorage cannot be found in the loose rocky soil. It was also found more satisfactory to pass the chokers round the centres of the logs instead of their ends, as they more easily cleared themselves from the many rocks and tree stumps on their way to the engine log dump. The logs vary in diameter and length, the heaviest hauled in being oak logs 16 feet long and up to 2 feet 6 inches diameter. A variety of timbers are felled in these coupes each year, approximately one-third being hardwoods, mostly oak, and two-thirds softwoods. The hardwoods and certain woods such as *champ* (*Michelia Champaca*) have to be converted into sizes suitable for buildings, furniture, etc., whilst the softwoods are all converted into planking for tea-box manufacture. A portable American sawmill has been installed just below the old Military Road to carry out this conversion of the logs. The mill is a temporary one, built up solely on timber sills and in about six years, when the coupes are 2 to 3 miles away, the mill will be moved to a fresh site nearer the logging operations to save log-hauling costs. The mill started sawing in December and had sawn a large quantity of oak scantlings as well.

The sawn stock from the mill is taken by the stackers straight to the loading station of a small aerial ropeway which



E. DARJILING. HIMALAYAN RAILWAY SIDING RUNNING OUT
THE COUPE. SEEN PASSING THROUGH THE 1920 S&L
BENGAL.



CREW OF TIBETANS OF LOGGING ENGINE (ALL PORTERS FROM THE EVERES.
EXTENSIONS). TOONG SAW MILL. ELEVATION 7,000 FT. DARJILING
HIMALAYA

A. W. Harding, photo.



VIEW OF LOGGING ENGINE OPERATION AND SAWMILL DURING WINTER IN
THE HIMALAYA. 7,000 FT. ELEVATION. BENGAL.

carries it down the hill-side from an elevation of 7000 feet to 6000 feet, a distance of 3500 feet, to a stacking yard by the Darjeeling cart road and a siding on the Darjeeling Railway. This ropeway, which is gravity operated, has an endless cable 7000 feet long running round 7-foot diameter sheaves at the upper and lower stations and supported along its length by timber trestles varying in height from 10 feet to 30 feet, the greatest span is 650 feet; sixteen carriers of the fixed-clip type are spaced uniformly along the ropeway, so that eight descending loads—of 160 lbs. each—are always on the line whilst eight empty carriers are ascending the line. Up to $1\frac{1}{2}$ tons of planking can be transported."

In view of the fact that these hill forests have been under a Working Plan for many years, and that many areas have for so long been regarded as unexploitable owing to their inaccessibility, it will be readily conceded that the above operations demonstrate that modern ideas and methods are being brought to bear on extraction problems in the Bengal Forests.

In the Sundarbans Division the auction-coupe system replaced the old permit system in 1904. Extensive thinnings in *sundri* (*Heritiera minor*) pole forest were introduced about 1906 and later incorporated into Trafford's Working Plan. Farrington commenced linear enumeration surveys in 1907 which were utilized in the plan. Sample plots have also been laid out. The chief progress in reorganizing and placing exploitation on a sound basis was the result of Farrington's work whilst in charge between 1903-8. The old Chittagong Division was split into two in 1909, the Hill Tracts being separated, but not before the Maini Reserve had been almost ruined by extensive *jhuming*. In 1920 the Cox's Bazar Division was separated. Prior to 1918 no proper marking-hammer system existed in the Hill Tracts. The demarcation and survey of the boundaries commenced in 1913 and was fairly complete by 1925. A policy of taking up head waters of reserves in the hills and all land unsuitable for wet cultivation in the plains is being followed. Low-lying areas are being given up by the Department in exchange. The old type of staff (revenue station officers) is being eliminated and a proper forest staff is being gradually appointed.

ASSAM

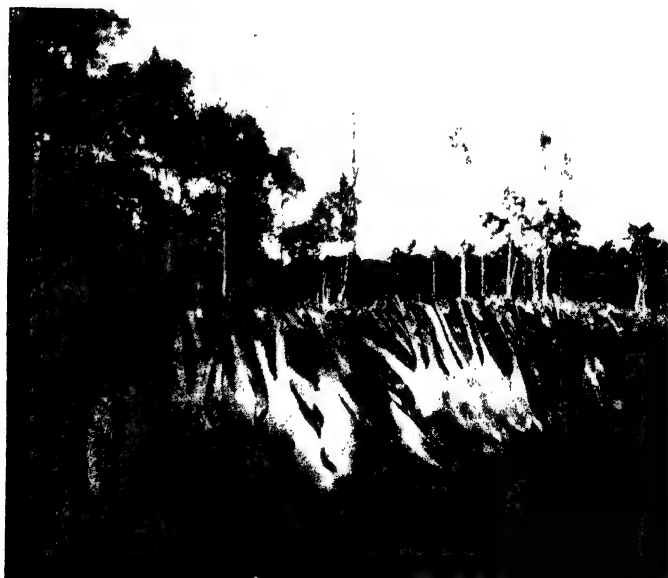
In Assam the trees are usually sold standing in the forest and worked out by elephants, buffaloes, carts or by flotation: Goalpara has, from the earliest days of forest conservancy, always been the show Division in Assam. Brandis, Schlich, Ribbentrop, Hill and Eardley Wilmot, and later Inspectors-General down to the present one, Clutterbuck, all visited these forests. As has been previously shown the trouble connected with the working of the forests, apart from malaria, is the absence of water. It was Perree, when appointed to the charge of Goalpara in 1904, who first practically solved the water difficulty by building a length of 2-foot tramline on which trolleys were operated by man power. This line has since been developed.

Before 1922 the coupes in Goalpara were sold by auction and were purchased by Mech, Bengali and Nepali contractors, the former extracting by water, the two latter by carts. The average price per tree was about Rs.9 in the Guma Reserve, Rs.14 in the Eastern Range. Very little green sâl was sold from the Central and Western Ranges. The contractors disposed of the material to middlemen in the log or pole form. The Government royalty was low and the middlemen made most of the profit. The contractors had little initiative and numbers of logs accumulated at the depots, as also outstandings of revenue. Bengal sâl was better known than that from Assam and had the easier outlet by the Eastern Bengal Railway. Of the four Ranges the growing stock in Guma was young and consequently of small size. Extraction was easy with a lead of 6-13 miles to the railway, with good roads and rides at the mile interval north-south and east-west. Thinnings are mainly prescribed for the Reserve. Extraction from the Eastern Range was more difficult, the lead being from 7 to 35 miles, the north-south and east-west roads and rides laid down in Perree's Working Plan having been neglected and being intersected by a number of streams running north-south which required bridging. Extraction by river was fair, but large trees could not be extracted by this means. The tramway extension sanctioned in December, 1922, and bridge building undertaken during the last three years or so (to 1925) brought about a great change, as the former opened out large tracts of forest for which a market had to be found by the Department, and the first idea was to sell sawn material. In



HIGH LEAD LOGGING IN THE HIMALAYAN HILL FORESTS WITH
AMERICAN LOGGING ENGINE. ELEVATION 7,000FT. TOONG,
KURSEONG-DARJILING DIVISIONS

G. H. Howlings, photo.



CUT FROM SÂI. TOPS READY FOR PASSING. SUKNA SÂI. TUNGUA,



THE IMPROVED AND BRIDGED COMPARTMENT OR BLOCK LINES IN THE GOAL-PARA DIVISION. THE FORD CAR AND THE ELEPHANT ARE THE CHIEF MEANS OF LOCOMOTION IN THESE SÂL FORESTS. FEBRUARY, 1925



TRACTOR HAULING A LARGE EVERGREEN LOG IN THE DHONI VALLEY, CHENAT NAIR EVERGREEN FORESTS, MADRAS PRESIDENCY

the outcome both sawn material and logs were exported. With the introduction of extraction of sawn material more carts became available and their prices for carriage dropped. Extraction from the eastern and central parts of the Eastern Range is now by carts, the tramway extension dealing with the western coupes. The headquarters of the tramway-engine houses, storage water-tank, etc., are at Kochugaon. The fixed portion of the railway runs from here 17 miles through the open country to join the A.B. Railway at Fakiragram and in the opposite direction a few miles to the forest boundary. From here extensions and sidings run into the felling coupes, both in the Eastern Range (west) and the Central Range, and will ultimately go into the Western Range. The logs are dragged by elephant and buffalo to the tramline, the distance never exceeding $\frac{1}{2}$ mile. Light tractors are suggested for this work. Contracts for sleepers are made by the Department, the contractors cutting and supplying them out of their contract sales; the method of sale now in force being the outright sale or lump sum offer for all the marketable trees in a coupe with a fixed time and scale of payments of royalty. Firewood is easily saleable in Guma. It is proposed to try out a portable charcoal kiln in the other Ranges. During 1925 the tram (only two engines being available) made two trips daily to the railway from Kochugaon during the working season. The revenue of 1922-3 was double that of 1921-2 and approached Rs.1,25,000 in 1923-4 (about Rs.85,000 in 1922-3). Mr. H. P. Smith was responsible for much of the development of the tramway and extensive bridging and building work.

BURMA

It will be remembered that when Brandis commenced his first organization of the Pegu Forests (I, pp. 380-381) he kept certain forests round Tharrawaddy to be worked departmentally in order that Government might retain some check on teak prices. This policy has persisted. In February, 1925, Mr. H. A. Watson, the Chief Conservator, wrote the following note with reference to teak: "The area draining into the Myitmaka or Hlaing River in Tharrawaddy, Zigon and part of Prome is worked by departmental agency. Otherwise, broadly speaking, the working of teak in Burma is in the hands of timber firms, the trees being selected and girdled by Government. The leases with the larger firms are of fifteen

years' duration and the current leases, which are now expiring, have a renewal clause which commits us for fifteen years." The old-time method of dragging the teak logs out of the forests to the streams and rivers down which they were floated was in force. The organization of these departmental operations has in recent years undergone considerable changes. A Forest Research Officer, Mr. A. Rodger, was appointed in December, 1913. During the following three years he undertook research work in Sylviculture, Forest Economy, Botany and Entomology. He had a small office and headquarters at Maymyo. A collection of forest products was gradually assembled and a Forest Economic Museum was formed at Rangoon, which has since proved very useful. During 1917-19 Rodger was employed by the Munitions Board, as already detailed. In January, 1920, a new Circle was formed, Research and Working Plans. It was at this time proposed to erect a Research Institute at Maymyo, but owing to lack of funds this project did not materialize. Instead, the Chief Conservator obtained the sanction to : (1) a Working Plans Circle with an additional post of Sylviculturist ; (2) a Utilization Circle on the lines adopted in the United Provinces. By the end of the War steps had been taken in the United Provinces to unite the various departmental wood-working and turpentine producing activities of that Province under the guidance of one administrative officer, who was to have control of a Government-owned sawmill, turpentine factory and experimental woodwork shops as well as of the timber sales throughout the Province. This idea was introduced in Burma, and Mr. J. C. Hopwood was appointed to the charge of the Utilization Circle. The first work undertaken was the disposal of war surplus stocks. The Rangoon, Moulmein and Mandalay Depots were first placed under the Circle, but the two latter were subsequently restored to the territorial Conservators. A general control was exercised over all auction sales of teak. Arrangements were made for the despatch and sale in Europe of consignments of hardwoods of various species. A Government sawmill and workshops for cooperage, turnery and veneer (on the United Provinces lines) were sanctioned for the Rangoon Depot.

The result of the supply of the Munitions timber, which totalled some 202,221 tons consisting of many different species, was to bring out vividly the fact that the much-neglected "junglewoods" of Burma, i.e. species other than

teak had a range of utility which had hardly been suspected. This and the post-war boom led in Burma, as elsewhere, to proposals which contemplated large developments in State-owned commercial undertakings. That inevitable modifications have had to be introduced, W. R. Robertson, the present Utilization Conservator, shows in the following clear exposition (1925): "One of Mr. Hopwood's first activities was to dispose of the surplus of the Munitions timber stock remaining after the Armistice and this coincided with the holding of the Empire Timber Exhibition in London in 1920. At this Exhibition the Indian and Burmese timber exhibits were very successfully shown by Messrs. W. W. Howard Bros., of London, who in 1919 had been appointed agents for the sale of Government timber in Europe, resulting in an increased interest both in Europe and locally in the timbers of the Province. At the Wembley Exhibition of 1924 a similar very successful exhibit was put up by the same firm. To keep alive this interest, stocks of timber, including some of the Munitions timber, were sent to Europe and the question of establishing the large Government sawmills at Rangoon and Mandalay was proceeded with, reaching the stage of ordering machinery from America for a large output mill, while several forest areas were examined with a view to starting wholesale lumbering after the American model." Mr. F. A. Leete, Chief Conservator, had been deputed to America to study lumbering. "The scheme of erecting the large sawmill received a check when the principal teak lessees of the Province protested against competition on the part of Government in the market for converted teak, a competition which threatened to be serious in that 25 per cent roughly of the Province's output of round teak was extracted by Government through departmental agency and it was rumoured that the operations were to be extended to raise the proportion to 50 per cent. As a result of the protest the Provincial Government engaged not to saw teak for the general market, a promise which at once cut off the principal input of the proposed mill. About this time also the great slump in the world's timber markets began to make itself felt, while the problem of supplying by rail the large input of hardwoods required by the mill began, on closer examination, to be very much more serious than was anticipated. In the end the idea of a large-scale Government sawmill was dropped. As a necessary corollary to the original idea of milling teak

by departmental agency the principal areas of teak extraction operations worked by departmental agency in the forest draining into the headwaters of the Rangoon River had been united into one body under the control of the Utilization Circle in supersession of the original programme, so that the whole disposal of the teak worked by Government is now under one control from stump to market. By 1922 the whole idea of Government entering into the manufacture of sawn timber or finished goods had been abandoned, although much of the necessary plant had been bought. In the light of the subsequent experience of the State-owned wood-working factories in the United Provinces there can be no doubt of the wisdom of this step."

The duties of the Utilization Circle therefore required reorganizing, and the Forest Economist from Dehra Dun was invited to visit Burma and advise on the position. The work of the Circle now falls into the following branches: (1) Teak extraction from the Myitmaka Forests and its disposal, with liaison with other teak timber disposals in Burma. (2) Collection and disposal of hardwoods with a view to creating new export markets. Surveys of supplies. (3) Scientific timber research such as Wood Technology, Timber Testing, Wood Preservation, Minor Products, etc., conducted at Dehra Dun with materials supplied from Burma. (4) Technical research such as seasoning and manufacture carried out in the workshops at Rangoon. Preparation of trade samples, either bulk or manufactured. (5) Collection and distribution of information regarding Burmese timbers and forest products. (6) Agency work for the rest of the Department.

According to the most recent figures the capital invested in Government teak operations amounts to Rs.57 lakhs, while hardwoods and research are valued at Rs.14 lakhs. The problems before the Utilization Circle are to find use for over 1000 woody species which comprise the forests of Burma.

As has been said, the departmental timber operations of the Tharrawaddy, Zigon and Prome Divisions are under this Circle. The extraction officers, Forest Engineers, take over the timber, large and small, in the forest and drag it out by elephant or otherwise and float it to Rangoon. It is here collected in a series of prepared pools, being floated in through lock gates. When full of logs the pool is emptied of water and the logs sorted. At Rangoon there is a sawmill,

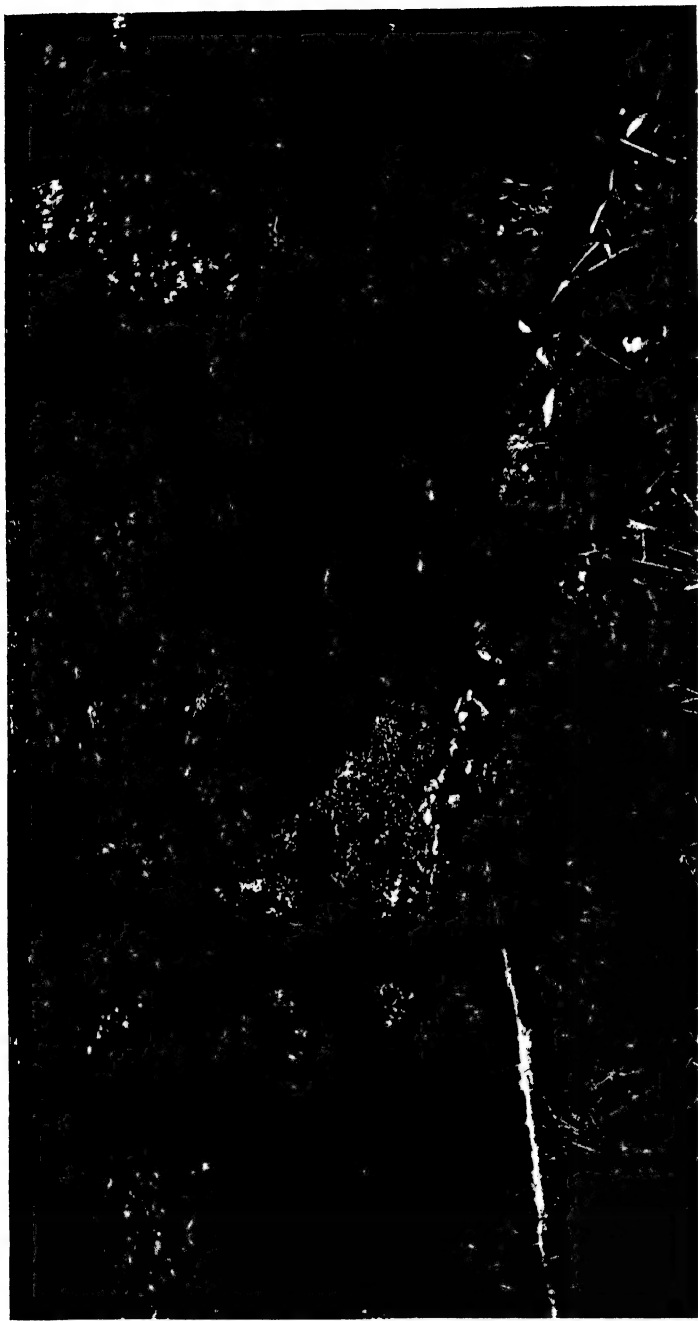
wood workshops, a drying kiln and air-drying sheds for carrying out experimental research work. Linked with the work of Government teak extraction in the Myitmaka Forests is the important and very successful river training works which have been in progress since 1915. These works, in addition to reducing very considerably the cost of transporting the timber, have reclaimed to date some 20,000 acres of flooded land, turning it into first-class arable land. The scheme owes its inception to Mr. F. A. Leete, lately Chief Conservator in Burma, but the later extremely successful development of the methods has been carried out by Mr. G. C. Cheyne. Reference should be made to *River Training without the use of Embankments*, by Leete and Cheyne.

Owing to the deltaic nature of the rivers numbers of logs were annually spread over the country-side and had to be salvaged by elephants or other means at considerable expense. From a Memorandum by Cheyne the following summary of this work is given :

" The Prome and Tharrawaddy Forests lie on the western slopes of the Pegu Yomas, and are drained by the feeders of the Rangoon River, which is known as the Myitmaka River at its headwaters and lower down as the Hlaing River. This river has a total length of 230 miles. The teak forests in the Shwele Range, Prome Division, and all those of the Zigon and Tharrawaddy Divisions have always been managed departmentally in order to provide a stock of timber for auction sales at the Government Timber Depot, Rangoon. The floating of timber from these forests to Rangoon has given rise to various controversies between the Civil and Forest Department during the past thirty years, and in 1909 it was seriously proposed to abandon the rivers altogether in favour of extraction by rail. It was argued that the cost of this method as compared with the apparent cost of entire water transport would be more than compensated by the fact that there would be a smaller loss of logs in transit and a quicker return would be made certain. The loss of logs when passing through the deltaic mouths of the streams where they join the Myitmaka had been considerable. The boom experiment was first tried at Wegyi, a point 1 mile west of the railway on the Shwele stream. Logs were collected by means of a boom across the stream, hauled out by winches and then loaded by jib cranes or gantries into trucks and railed to Rangoon. The depot was in full work during the seasons

of 1913 and 1914 and was a successful experiment until a better method was found in 1914 and the depot was finally closed in 1915. The losses in transport when the Wegyi boom was in vogue were often as high as 5 per cent, and undoubtedly a large number of logs which escaped from the boom were irretrievably lost in the silt deposits of the lower reaches of the Sheweale stream. Mr. Leete took the systematic training of the rivers in hand in 1914 in the Prome, Zigon and Tharrawaddy Divisions, and since then it has been incontrovertibly proved that given a timber that will float no form of transport can hope to compete for cheapness with water transport.

All the Yoma torrents, due to their reception basins being highly susceptible to the excavating power of the rainfall, carry enormous quantities of silt and rubbish of all sorts during floods, and when their flow is checked by the backing-up action of the Irrawaddy the silt is rapidly dropped. In the past no adequate control was maintained, with the result that there have been continual changes in the channels in their lower reaches and the torrents have traversed the plains in all directions, but these divagations have at any rate served to raise the level of the plains considerably. Various reasons were given to account for the deterioration of the streams, and both Civil Officers and Railway Surveyors assailed the Forest Department as the cause of the evil, and there can be no doubt that the lack of adequate floating control and the failure to remove obstructions as soon as possible after formation were the principal causes. In 1914, after consultation with the late Mr. Samuelson, Leete decided that the most effective way to improve matters would be to double embank the channels at the places where the well-defined channels began to deteriorate. High embankments were therefore made at critical places on four of the streams before the 1915 rains. These measures were most successful so far as the embankments extended, but no good channel was obtained below the end of the embankments and logs were spread out fanwise over a large area. The problem of how to carry on the further improvement in the channels subsequent to the rains of 1915 now arose. Engineers strongly recommended that the high embankments should be extended, but on the grounds of economy an experiment was made in 1916 substituting low embankments for high embankments. Since 1916 it has been proved that the high embankments are not a necessity,



WILD ELEPHANT TIED UP FORE AND AFT AFTER CAPTURE FOR TRAINING. BURMA

H. R. Blanford, photo.



GORGE AT THETUGEBIN LOOKING UP STREAM AFTER A JAM OF 3000 TEAK LOGS HAD BEEN BROKEN UP AND LAID
OUT ALONG THE STREAM. BURMA

but that in addition to involving considerable capital outlay, many disadvantages follow in their train, especially to cultivation. Low embankments were made in the Taungnyo stream for a distance of 1 mile in 1916, but, as the moment an embankment was overtopped by a flood, scouring immediately took place from the outer side of the embankment towards the stream the embankments were breached in many places during the first jungle flood. Therefore the experiment proved a failure. Experience, however, gained in dealing with the numerous breaches which destroyed the low embankments proved the value of bamboo-stake fences in controlling the flow of silt-laden water. This induced Leete, in his recommendation for the preparations for the 1917 rains, to suggest systematic application of the method which has been known to the cultivators in these riverain plains for many years. Instead, therefore, of continuing the training of these Yoma torrents with embankments, bamboo-stake fences alone have been used and no embankments whatever have been made since 1916. The continuation of all channels into the *laha* has been brought about and controlled by means of simple bamboo fences. For purposes of description of the manner in which the "No Embankment" method is applied an average state of affairs in any stream at the end of a rainy season may be considered. The condition of the stream is that a channel has been forced to a certain point and kept in place by herring-boned strings of logs. Below this point the channel for some distance is clearly defined in the silt deposits, the late rises having scoured a passage through the fan of silt thrown out in front of what may be considered the stream mouth. Side channels from this passage have been blocked with logs. Below this the channel is merely a depression in the stiff *laha* clay. The line along which it is desired to form the new channel is then pegged out and usually follows more or less a natural depression. All jungle growth to a width of 150 feet each side of the line is cut down flush with the ground and burned or cleared away. One hundred feet on each side of the line simple bamboo fences are made. These consist of bamboos, 5 to 6 feet long and pointed, driven into the ground about 9 inches apart and their tops dressed to an even height of about 3 feet above ground level. These stakes are lashed to an horizontal rail with coir rope about 6 inches from their tops, to hold them in position. Where this fence crosses side channels the bamboos naturally stand higher

out of the ground and must be strutted to enable them to withstand the additional pressure at these points. Any bad bends are eliminated by cuts. The low fences are continued just beyond the point which it is anticipated will be the limit of the silt deposit of the ensuing rains. The fences catch up the many kinds of small rubbish brought down on every jungle rise and form a barrier checking the flow of water, the finer particles being carried beyond it. In this way each rise serves to heighten the banks now forming, as well as to raise the level of the surrounding country. It will thus be seen that the channels being formed are not made by scouring a bed, but, on the contrary, the stream is induced to deposit its silt evenly along its course and to raise banks for itself. Each successive rise further heightens the banks and lessens the overflow, thereby leaving more water available to flow farther downstream to enlarge the section there. Care must be taken to keep the fences in repair. With the continuance of this work the channels are being carried year by year farther downstream. Along the shelf of the deposit on either bank of the stream cultivation of paddy has now been rendered possible where ten years and less ago annually inundated scrub jungle was the only vegetation. Furthermore, this new cultivation is permanent and free from danger from all but the highest of the Irrawaddy floods, while the margin of absolute safety is annually being moved farther downstream.

The primary object of the Forest Department River Training Works is to obtain a channel through which to float teak logs as cheaply as possible, and the channel, once formed, is very easy to maintain. The Civil Authorities now propose to demarcate the entire area which has been affected by the training works since 1914, and over which no land-holders rights have accrued, and this will constitute a Government estate. This estate will include all the land which may be required in the future for further stream training and, if the necessity arises, to move the course of any stream, either for cheaper floating of teak logs or for additional land reclamation, costly acquisition will not have to be faced. If this estate is constituted as now proposed it is contended that many more thousand acres of valuable paddy land will be reclaimed in a few years and the process of frequent changes in the course of each channel or of opening large silt-carrying irrigation cuts to fill up depressions will in course of time render the whole of the Myitmarka Valley culturable."

Formerly the extraction of teak in the Tharrawaddy and other Divisions worked departmentally was carried out by the Divisional Officer. As the importance of the work came to be recognized Timber Assistants were appointed, the first in 1910-11. Up to 1909-10 the work had been done by contractors who delivered the logs at the rafting station, Sanye, in the main rafting stream. After this date the Department took over the actual control of the logs in transit below the railway. With the development of the river training works and the control of logs in transit a system was gradually evolved in the actual logging work in the forest. The staff of gazetted officers was increased until in 1917 Timber Assistants were attached to each main Division. In 1920-1 the extraction work was formed into a Division, designated the Myitmaka Extraction Division, and placed under the Utilization Circle, a special grade of Timber Assistants being sanctioned. The outturn in the year 1923-4 was 75,098 logs.

Allusion has been made to the fact that the working of teak in Burma, outside the areas worked departmentally, is in the hands of timber firms under a system of 15-year leases, the trees being selected and girdled by the Department. This method of exploitation on so large a scale is peculiar to Burma. In the interests of this history it appeared advisable to have the views of the lessees on the subject and I accordingly, whilst in Rangoon, called on the Manager of the Bombay-Burma Trading Corporation, Limited, with this end in view. Sir A. Anderson very kindly gave me the following Memorandum (dated Rangoon, 19th March, 1925) which, if it does not perhaps furnish all the information one would have liked, is not without some considerable historical interest. I have slightly rearranged the sequence of the Memorandum for convenience of reference.

" With reference to your call on us when you were in Rangoon, we have much pleasure in enclosing : 1. A statement (A), showing the tonnage of teak extracted from the Burma Forests by lessees since 1900, as shown by the Forest Administration Reports together with the royalty paid by them in the years 1908-09 and all years from 1910-11 inclusive. The reports do not give the royalty paid for the earlier years nor in 1909-10.

(A). SUMMARY OF TEAK EXTRACTED BY LESSEES

Year.	Tons.	Revenue. Rs.
1900-01	170,602	—
1901-02	86,160	—
1902-03	91,919	—
1903-04	122,369	—
1904-05	130,393	—
1905-06	125,338	—
1906-07	152,987	—
1907-08	153,719	—
1908-09	208,587	40,12,465
1909-10	229,165	—
1910-11	253,840	50,07,682
1911-12	201,209	41,51,550
1912-13	204,329	48,10,040
1913-14	226,119	50,59,929
1914-15	232,368	52,92,553
1915-16	241,483	55,29,748
1916-17	313,660	69,72,642
1917-18	276,896	63,25,146
1918-19	221,680	52,76,959
1919-20	314,529	71,10,201
1920-21	322,660	72,97,088
1921-22	454,010	105,92,246
1922-23	401,582	90,21,812
1923-24	451,028	101,84,996

2. A statement (B), showing the tonnage of teak extracted from the Burma Forests by Government Agency since 1900, as shown by the Forest Administration Reports. The revenue derived from this teak is not ascertainable. Although it might be possible to trace certain gross revenue figures for it from the annual budgets, the result could only be valueless for the purpose of comparison with the figures in Statement A, or for any practical purpose, because it is impossible under the Government system of accounts to discover the corresponding expenditure debitable. In order to discover the net revenue commercial accounts are essential, the capital lock-up must be shown, interest must be charged, and if a true comparison between the two systems of working the forests is required, many allowances must be made for comparative quality of the timber, difference in cost of working and in nature of staff organization, creation of reserves, and various forms of rates and taxes from which Government is exempt, but which it obtains from lessees in addition to royalty.

(B). SUMMARY OF TEAK EXTRACTED BY GOVERNMENT

Year.	Tons.	Revenue. Rs.
1900-01	51,856	—
1901-02	60,333	—
1902-03	60,479	—
1903-04	100,959	—
1904-05	76,487	3,50,114
1905-06	86,438	—
1906-07	71,065	—
1907-08	61,839	—
1908-09	50,559	—
1909-10	49,683	3,19,584
1910-11	47,572	—
1911-12	43,182	—
1912-13	40,347	—
1913-14	52,197	—
1914-15	50,305	2,33,603
1915-16	64,759	—
1916-17	77,580	—
1917-18	89,180	—
1918-19	88,440	—
1919-20	103,600	4,23,559
1920-21	102,020	—
1921-22	125,120	—
1922-23	106,300	—
1923-24	102,020	4,35,460

3. A statement (C), showing the average outturns per annum for lessees and Government for five-year periods from 1900 to 1920 and four years from 1920 to 1924.

(C). SUMMARY OF TEAK EXTRACTED BY LESSEES AND GOVERNMENT

Lessees.	Total. Tons.	Average per year. Tons.
1900-05	601,443	120,289
1905-10	869,796	173,959
1910-15	1,117,865	223,573
1915-20	1,368,248	273,650
1920-24	1,629,280	407,320
	<u>5,586,632</u>	<u>232,776</u>

Government.	Total. Tons.	Average per year. Tons.
1900-05	350,114	70,023
1905-10	319,584	63,917
1910-15	233,603	46,720
1915-20	423,559	84,712
1920-24	435,460	108,865
	<hr/> 1,762,320	<hr/> 73,430

4. A statement (D), regarding annual expenditure in Burma by the lessees, the size of the labour force which they employ and the amount of capital locked up in their present operations. With the exception of the capital lock-up, this information was quoted by His Excellency the Governor in his Durbar speech in December, 1924.

(D). Present Annual Expenditure in Burma by Teak Forest lessees, *excluding* European salaries, imported stores, oversea freight paid in Burma, income-tax, interest, royalty, and *including* estimated expenditure by European staff in Burma :
Custom Duty, Rs.225 lakhs ; Royalty, Rs.80-100 lakhs.

Total, Rs.300-325 lakhs.

Labour roll, including Contractor's men, 55,000. Multiplied by 4, to allow for dependants, say, 220,000.

Capital lock-up, Rs.9 to 10 crores.

The above information is all that we feel in a position to supply, but we trust that you may find it of use."

As regards the remarks made anent capital lock-up, interest and staff organization, it may be remarked that the capital lock-up of the Government is represented by the value of the large area of forests under scientific management, which represents a gigantic amount of capital ; interest is represented by the annual increment in wood yearly added to the growing stock, whilst the expert administration of a trained staff yearly adds to the increased potential value of this locked-up capital, which is represented not only by the growing stock but in the increasing productivity, and therefore value, of the soil.

BIHAR AND ORISSA

This Province is a new one formed out of portions of Bengal with the Sambalpur District of the Central Provinces added. The chief forests of importance are situated in the old Sing-

bhum Division, now divided into four Divisions, of which the Saranda, Porahat and Kolhan are the chief. In the two first-named a five-years' lease, which expires this year (1925), was given to the Bengal Timber Trading Company. Under the lease Government required the Company to erect four sâl mills in each place, a condition being that the Department would have to take them over if the lease was not renewed. The Conservator, Dicks, is of the opinion that the number of mills is excessive, that two in each place would have sufficed. The Company are not doing too well, though the slump in timber values may be one cause, and state that it costs four times as much to saw sleepers in the mills as by the time-honoured method of pit sawing in the forest (*vide* Plate facing p. 514, Vol. II) ; they were unable to sell scantlings as Calcutta prefers teak scantlings from Burma. The Research Officer informed me that sâl poles were sent from Sambalpur to Calcutta passing through the Saranda and Porahat Forests from which the Company refuse to send any as they will only occupy themselves with timber ; very much the same state of affairs as found elsewhere in India. The mills in Saranda and Porahat took some time to erect and have only been working for two years, the Company say at a loss. The Conservator considers that the timber from these forests would sell better at auction but that the Company have a moral right to an extension of their lease and will probably receive it though without the clause compelling Government to take over the mills at the end of the lease if the forests are resumed. Elsewhere the method of disposal of the produce is by auctioning the coupes, the latter being divided up into several lots in order to enable the small merchant to compete, much on the lines in force in France.

There is no Utilization Circle in the Province, Nicholson being the only Research Officer at present.

THE CENTRAL PROVINCES

The usual method of disposing of forest produce in the Central Province is by auctioning the coupes to contractors, generally in July. The auction is with a reserve price and upward bids. In the major portion of the sâl forests the material is sold at sleeper or scantling rate, the contractor paying on outturn. The price per sleeper or scantling is usually fixed by auction or tender. In the departmental felling of

coupees to be mentioned later the contractor either purchases the material after felling or after logging, or pays for the material at toll stations. (In the Melghat only.) The method in two felling series in the South Chanda Division (Allapilli) will be alluded to later. Transport is chiefly by road or rail in this Province. The narrow-gauge line from Gondia to Ghanda is mainly supported by forest produce, and its construction was of immense value in opening out the forests. This line is a prolongation of the narrow-gauge line from Jubbulpur to Gondia. It is proposed to construct a new 2-foot gauge line to tap the South Raipur Sâl Forests for the supply of sleepers, the new Working Plan being based upon the opening out of the forests by this line. River transport is chiefly limited to the Godaveri in the south and the Narbada. The latter river serves Jubbulpur and Narsingpur. River rules, based on those in force for South Chanda and the Godaveri, are in course of being framed. The produce of the Sironcha Range of the South Chanda Division is floated down the Godaveri. This river has no longer the volume of water which passed down it a century ago. The enormous destruction of forest on its head-waters and those of its chief tributaries during the first-half to three-quarters of last century has resulted in great sand banks and bars being formed in its bed. Early in March, 1925, I had hoped to have been able to proceed down it by raft or small boat to Rajamundhry, but found the trip impossible owing to lack of water even at that early period in the hot weather (I, pp. 77, 320, 321). Advance in methods of exploitation in the Central Provinces, with the solitary exception of Allapilli, worked under the plan prepared by Clutterbuck, is a plant of recent growth. The Province had stagnated for years, some say for thirty years. Sir Henry Farrington, a Bengal Officer, was appointed Chief Conservator in May, 1922. After a study of the position of the Department he applied to the Government for an increased grant for cultural operations and some increase in the posts of Rangers to undertake marking work. The following extract from a Memorandum kindly written for me by Farrington (24th June, 1925) indicates the position :

"In 1922-3 and 1923-4 increased grants were sanctioned for Forest Expenditure, while in 1924-5 a reorganization of the Subordinate Establishment costing Rs.30,000 was approved of. Full effect could not be given to this last benefit owing to the poor quality of the existing staff and to the lack of

previous arrangements for recruitment in excess of the post. Seven more Provincial Forest Service posts were sanctioned with effect from 1925-6, which will absorb existing probationers and such of the temporary Extra Assistant Conservators of Forests as are worthy." The Chief Conservator says that the main arguments against a change in forest management were that funds would not be available in order to improve the methods of exploiting the coupes, that there was a labour shortage (in spite of the fact that this Province is the chief recruiting-ground for the tea gardens) and that changes would drive away contractors—all well-worn arguments as this history has demonstrated. The method introduced of working the coupes has already been described in a previous chapter. In many parts extraction methods from the coupes have greatly improved, as also the revenue ; since the cutting down of the size of the coupe now enables it to be thoroughly worked out before being quitted. Contractors also have to work to time, and outstandings of revenue and sums to be "written off" are decreasing. The departmental working, commenced in 1922, has materially improved the situation. The latest figures (1925) of a coupe worked in this fashion and sold in small lots may prove exceptional, but they indicate a net return of Rs.15 per acre. This form of exploitation is being increasingly employed.

The most important and interesting exploitation work is in the Allapilli Teak Forests of the South Chanda Division. This work is being done departmentally and furnishes a fine illustration of work carried out on old lines but up-to-date methods. There is some magnificent teak in these forests situated in hilly and often difficult country. The logs are hauled on to the well-constructed roads by elephants or buffaloes. From here they are loaded into buffalo or bullock carts and carted some 80 miles to Ballarshsh Depot, situated at railhead on the G.I.P. Railway. A new sawmill has been recently erected at this depot and a part of the material is converted before sale. The rest is sold in log form at auctions, of which previous notice is published. A point of interest was the insistence of the Chief Conservator that the most careful supervision should be maintained over the felling and logging operations in the forest in order to prevent waste by felling too high up the stem or by leaving a log with a hole in one end of it. When the carting lead is one of 80 miles losses caused by lax supervision can easily run into a high

figure. With so long a carriage, and especially during the hot-weather months, it was necessary to protect the ends of the logs with a thick coating of clay and cowdung to prevent, or reduce, cracking. The Allapilli teak has been famous for a century and more, as has that of the neighbouring Ahiri State (I, pp. 77, 321). These extraction operations proved of the greatest interest. So far, cart transport from the forest to the depot has proved the cheapest. It is questionable whether motor lorries would be either practicable or cheaper owing to the doubtful quality of the road surface for motor traffic.

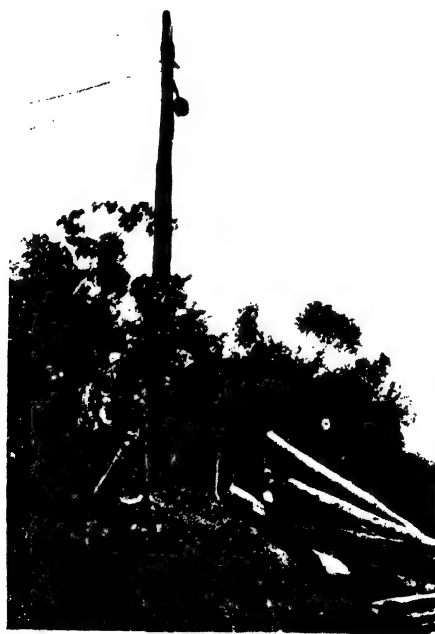
MADRAS

Perhaps one of the most remarkable developments in the preparation of a well-considered scheme of forest exploitation in India has been made in the Madras Presidency, initiated by Messrs. S. Cox, C.I.E., lately Chief Conservator, and C. S. Martin, Chief Forest Engineer. The origin of this development commenced with a tour of Madras by Mr. Martin, at the time Consulting Forest Engineer to the Government of India, in 1920-1. Cox and Tireman, then Conservator, VI Circle, decided that the general schemes for forest development outlined by Martin could not be successfully carried out by the existing organization of the Department. Much of the work was of a highly technical nature requiring special training in forest engineering, etc.; the inauguration of the schemes would also involve many new problems in providing for the regeneration of large areas of exploited forest, a matter requiring considerable research and organization. This would entail more work for the already overtaxed Divisional Officer, whereas the latter should be relieved of all the engineering and exploitation work in order to enable him to carry out his purely professional duties. On the other hand, it was pointed out that by allocating the engineering and utilization to men trained for such work, the general efficiency of the Department would be raised and greater continuity of policy secured. From this basis the details of the proposed organization were worked out by Cox and Martin in April-May, 1922, a preliminary Report being sent to the Secretary to Government, Development Department, by the Chief Conservator with his demi-official letter, No. 154, dated 20th June, 1922, and his further Report to the same (No. 33—A, dated 10th August, 1922). It is impossible to



NO. IV SKIDDER READY FOR WORK, DHONI VALLEY, CHENAI NAIK EVER
GREEN FORESTS, MADRAS

Major W. F. Chipp, photo.





SKIDDER NO. IV. WITH FRONT END LOADED ON BUMMER BEING PULLED TO NEW POSITION BY NO. I TRACTOR. DHONI VALLEY, CHENAI NAIR, MADRAS PRESIDENCY



BULLOCK CART ON HIGH ROAD, SAPPAL VALLEY, TRANSPORTING LOGS TO SAW MILL AT OLAVAKOT ON THE RAILWAY, 8 MILES AWAY. THIS IS STILL THE CHEAPEST METHOD OF TRANSPORT FROM THE ROAD TO THE MILL. CHENAI NAIR EVERGREEN FORESTS, MADRAS PRESIDENCY

W. F. Chipp, photo.

reproduce the proposals contained in these Reports in detail, but the following extracts are necessary :

" The debates on the Forest Budget in the Legislative Council of last March bring to an end a three-year period of preliminary investigation, wide publicity and discussion of the possibilities of forest development in Madras. It is now accepted that there are great possibilities of profit in the hitherto untapped forest resources of the Presidency, and that a special organization is necessary to push the work of developing these resources forward. The appointment of a Chief Forest Engineer has been approved by the Legislative Council, and promise has been made by Government in the Budget for his appointment during the current year." A Logging Engineer and Utilization Officer were also to be appointed. An Exploitation Officer had been appointed from August, 1922. In addition, two Assistant Conservators and three Extra Assistant Conservators were to be sent to the United States for training for the special Engineering branch, the formation of which was the object. The Government, in their No. 340 Development, dated 5th March, 1923, sanctioned the proposals. The new scheme was based on the possibilities of development of the following forest areas. The figures are of considerable interest :—

Forest.	Acreage of exploitable timber forest.	Estimated standing Forest Crop in tons.	Possible net annual revenue when forests are fully developed. Rs.	Present approx. outturn of timber and gross revenue derived therefrom.	
				Tons.	Rs.
S. Kanara Forests .	370,000	6,000,000	15,00,000	1,000	39,000
Nilambur Valley Forests .	32,000	447,000	7,50,000	5,700	2,32,000
Malabar Evergreen Forests .	58,000	2,150,000	3,22,500	1,000	60,000
Wynaad Forests .	120,000	1,100,000	5,50,000	3,000	1,17,000
Mount Stuart Forests	25,500	250,000	1,00,000	2,000	2,08,000
Tinnevely Evergreen Forests .	35,200	3,000,000 (including fuel)	4,00,000	nil.	nil.
	640,700 or 1,000 sq. m.	12,947,000*	36,22,500	12,700	6,56,000

Owing to the then existing system of accounting and to pressure of work, the Chief Conservator was unable to give the net revenue

* Equivalent to 648 millions of cubic feet, or about 6½ billions of board feet (planks).

derived from timber operations in the above forests. There were other possibilities, such as the sâl forests in the Khond Agency, the large forest tracts in the Golconda, Rampa and Bhadrachalam Agencies, and the Nellamalai Forest in the Kurnool District, but little was known of these forests, which required careful investigation. Cox expressly safeguarded himself against any desire to exaggerate the possibilities of the unexploited forests or of finding markets for their products. But in a matter of so great importance to the Presidency, he considered it necessary that expert advice should be made available and that thereafter the development should be gradual and only undertaken when a scheme had been worked out as a profit-making enterprise.

Exploitation in the Chenai Nair Forests in the Palghat had been proceeding; the operations had been reduced pending further investigation into marketing possibilities. It was in this area that the first large project was launched, as will be described.

Mr. Martin was engaged in August, 1923, for a three-year term, to organize, with the assistance of a Logging Engineer, a Forest Engineering branch. He was deputed to America to select the latter, and arrived in Madras with Mr. Pearce in October, 1923. The two officers at once commenced to organize existing operations and to carry out enquiries into possible exploitable areas in order to be in a position to draw up a comprehensive scheme of work covering a period of years. A Forest Economist was appointed, under the Chief Forest Engineer, and a Minor Forest Products Officer was added to work under the Forest Utilization Officer. The Engineering Branch accounts were supervised by the Accountant in Martin's office, with the guidance of a firm of Chartered Accountants in Madras. In a Memorandum kindly written for me (1925), Martin describes the development in the following words: "The Forest Engineering Branch expanded very rapidly, and in little more than eighteen months included thirteen gazetted officers, nine from the Imperial Forest Service and four from the Madras Forest Service; one of the former being deputed to the United States of America, England, the Philippines and Borneo to make an extensive study of forest utilization subjects, another being deputed to Dehra Dun each year to keep in touch with the work being done there and to co-ordinate our work with theirs, three others merely being deputed to the Forest Engineering Branch for training until the formation of the Working Plans Circle. (These men have since been transferred to the Working Plans Circle.) Twenty-two Rangers and thirty-two Foresters and nine Forest Guards were employed in the Exploitation Division on roads, bridges and surveys, and in mapping and enumeration work under the Logging Engineer."

Briefly, the Chief Engineer claims that it has been demonstrated in Madras that logging can be carried on in almost any type of

country, using modern mechanical methods, and at a competitive cost. The present cost of delivering logs at Olavakkot from the Chenat Nair Reserve, working in a very rugged steep country, transporting the logs 8 miles and down 1500 feet in elevation is only about one-third the average cost of logging in the Philippines under similar conditions, and of logging in the United States. The erection of a small, modern, semi-portable sawmill and box plant at Olavakkot, with a three-chambered Sturtevant dry kiln modified to suit Indian conditions, will demonstrate, it is hoped, that methods of handling timbers now judged as worthless will be possible in order to prove their value and usefulness. These operations are being carried out on the lines described for the Research Institute at Dehra Dun.

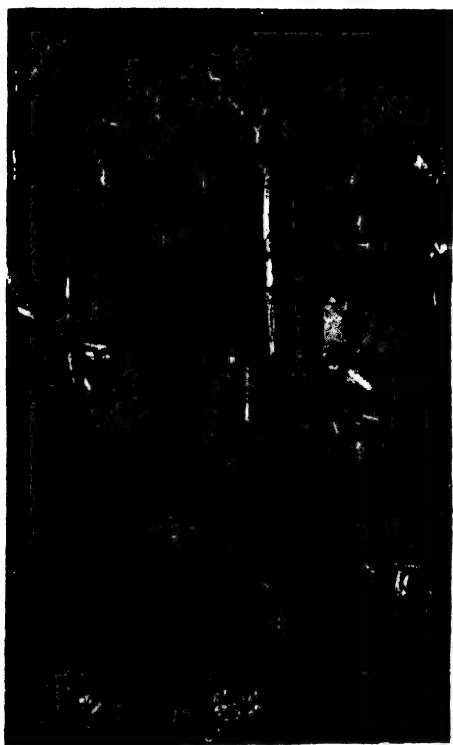
All large compact forest areas are being mapped and enumerated in detail, so that development may proceed and Working Plans be drawn up, based on actual surveys and detailed information. The object in view is to be able to forecast the outturn accurately several years in advance, if desired. Close co-operation with a Working Plans Circle will ensure that future plans are drawn up with due attention to engineering and extraction lines in so far as these do not conflict with silvicultural requirements. The present organization is more or less experimental, and the Chief Forest Engineer considers that eventually, as soon as a senior trained utilization expert is available, the head of the branch will be a Utilization Conservator, and that the Forest Engineering side of the work will be relegated to its proper position as one of the departments necessary to a full utilization and to the efficient management of the forest areas of the Presidency.

The first large project being undertaken is the exploitation of the Chenat Nair Evergreen Forests. The organization and management of this work under the Forest Engineer (Major W. F. Chipp, D.S.O., M.C.) furnishes an object lesson of the practicability of exploiting areas of forest in India, long deemed inaccessible, on up-to-date lines. The work is allocated in four sections, Felling and Logging, Transport, Construction (roads, etc.) and Sawmills (including kiln-seasoning and manufacture).

All trees over 28 inches girth, which are marketable, are previously marked in the compartments and an estimate of cubic contents is framed. The trees are then felled and logged. Extraction is undertaken by "yarding," an expression covering all operations in removing the log from the forest up on to the cart-road. This work is done by mechanical power, the system employed being the "American High Lead." Trees are selected close to the road to serve as gyn

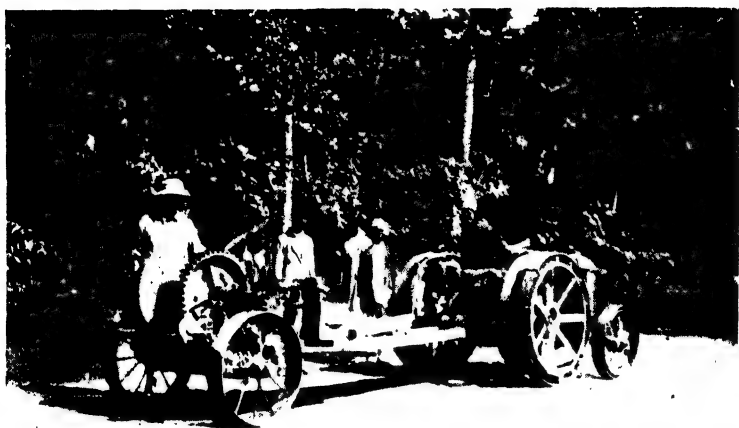
poles, or, if a tree is not available, a gyn pole is erected and by means of blocks and tackle work can proceed all round the tree. Two types of engines are used, a 5-ton Holt caterpillar tractor, 4-cylinder petrol-engine, developing 40 horse power at 1050 revolutions a minute. The other type is a Fordson engine of the same horse power. Stout cables are used, worked off drums and run by the engines. These evergreen forests contain large trees, some of gigantic dimensions. Broad roads, beautifully graded, have been driven up the Sappal Valley, now being worked, to near its head, an upper and a lower one. These parallel roads are some 1400 feet apart. Each engine has to haul half the logs up-hill and half down. The outturn of work done varies with the size of the logs, number of trees, nature of ground and length of pull. In the absence of accidents and with an average yield the Holt yards some 450 cubic feet and the other skidder about 600 cubic feet per day of eight hours in an area yielding 750 cubic feet per acre. In places where the yield is very scattered logs have often to be collected to the strips ready for the machines by coolies (the ground being too steep for animals) as it does not pay to rig up cables and tackle for a scattered yield. Logs, after being yarded to the roads, are sorted out on the road near and are then ready for transport. The logs are carried from the place where they are dumped by the engines to the sawmills and sales depot by buffalo and bullock cart, which is still the cheapest method. The sawmill has been recently erected and is up to date. Logs entering the mill at the band mill end can be converted and leave at the other end as planed match boards or in any size scantling required. The machines are arranged in such a way that all timber continually moves forward. A railway siding and covered loading wharf is situated at the outturn end of mill. The yard is equipped with cranes and tramway system. The seasoning plant has been already alluded to. Most of the timbers were originally used as firewood, other uses being unknown; now, by careful experiments in seasoning, the same timber is used for furniture-making, etc. The manufacturing work consists in making boxes, packing-cases, barrel staves and certain classes of furniture. The Plates exhibit the work being undertaken.

At the Beypur depot a small sawmill has been recently installed for cutting sleepers and scantlings from the excess timber coming from the Nilambur Teak Plantations,



THE DHONI VALLEY—SKIDDER YARDING.
LOGS SLIDING DOWN EARTH SLIDE ON NORTH
SIDE AND YARDED UP ON SOUTH SIDE.
PALGHAT DIVISION, MADRAS

Major W. F. Chipp, photo.



FORDSON TRACTOR AND THE HUSTON SKIDDING WINCH LEAVING DANDELI FOR WORK IN THE NAGJHIRI VALLEY. WEIGHT OF TRACTOR, 2,770 LBS.; WEIGHT OF WINCH, 1,800 LBS. N. KANARA, BOMBAY PRESIDENCY

T. S. Pipe, photo., 1925



FORDSON TRACTOR AND WINCH ON ROAD IN NAGJHIRI VALLEY. THE REAR ROAD WHEELS HAVE BEEN REMOVED AND ARE SEEN ON LEFT. N. KANARA, BOMBAY PRESIDENCY, 1925

T. S. Pipe, photo.

From 1917-18, under the Working Plan for the latter Area, 460 acres of mature teak plantations and 826 acres of natural forests were clear felled, also 4502 acres of teak plantations were thinned. The total output of timber from the above fellings was as follows: 1917-18, 309,641 cubic feet, value Rs.4,32,835; 1918-19, 356,340 cubic feet, value Rs.4,25,903; 1919-20, 249,006 cubic feet, value Rs.6,83,808; 1920-21, 1921-22, 319,062 cubic feet, value Rs.6,88,370; 1922-23, 396,994 cubic feet, value Rs.2,16,289; 1923-24, 304,641 cubic feet, value Rs.3,10,373; 1924-25, 355,112 cubic feet, value Rs.3,00,839.

Exploitation has been carried out departmentally in the Mount Stuart forests of the South Coimbatore District for many years. The timber was dragged to the tramway, hauled along the latter for some distance, and then carted to Pollachi for sale. The tramway is very old, was badly designed in the first instance, and is now (1925) worn out. It is said to have served its purpose and is to be replaced by a well-graded metalled road, now in course of construction. The road has been substituted for the steam tramway proposed in the Working Plan. In 1924 experiments were made with caterpillar tractors, but statistics obtained appeared to show that for Selection Fellings, as opposed to concentrated Clear Fellings, nothing could compete with the old method of dragging from the stump to roadside with elephants and then carting on country carts.

COORG.—The position in Coorg in 1924 was summed up as follows by the Officer in charge: "Sandal forests are being exploited heavily, during a period of depression in the timber market, in order to finance from the proceeds a project for extracting evergreen timbers from the Western Ghât Forests. These ghât forests give an annual coupe of some 800 acres for Clear Felling; and a yield of between 6000 and 12,000 tons per annum is available. The Forest Tramway built to negotiate this output in 1918-23 cost, with logging machinery, some ten lakhs of rupees. It is expected that final agreement will shortly be reached with a private firm to erect sawmills, box-making and veneer plant at the juncture of the Barapole River (down which the timber is floated from the end of the tramway) and the coast railway (S.I. Rly.) at Beliapatam. In the Eastern forests, owing to depression in timber trade, fellings (which could be an annual 250 acres a year, with a yield of 6000 tons of timber) are now limited to some hand sawing of sleepers,

BOMBAY

The recent developments in Forest Engineering and Exploitation in the Bombay Presidency have proceeded upon somewhat different lines to Madras. As regards major produce the work, broadly speaking, is carried out as follows : (a) In Kanara (e.g. Dandeli) and Surat Dangs High Forests the operations are departmental. (b) In small teak-pole areas the coupe is sold standing, as also in Thana where competition is very keen owing to the proximity of Bombay, coppice fellings being saleable. (c) The system of sale of standing coupes also prevails in Sind. (d) Sandalwood extraction in Dharwar-Bijapur and Belgaum, which are the chief Divisions yielding the material, is entirely departmental, also some sales from the Eastern, Southern and Northern Divisions of Kanara.

It is proposed to deal with the progress made in roads and buildings in a later section of this chapter. In the case of Bombay, however, the improvement in roads will be considered here, since it is interwoven with the improvements in exploitation methods which have been gradually evolved from the appointment in 1915 of Mr. Haines, Executive Engineer, Dharwar District, to enquire into the possibility of making the Kaneri (in Kanara) a torrential river with a bed of rock and boulders, floatable for logs. Mr. Haines started too late in the season and little was accomplished. The following year Mr. T. S. Pipe, now Superintending Engineer in the Forest Department, then Executive Engineer, Ahmednager District, was appointed for six months to carry out this survey. The work consisted of a complete survey of the lower 5 miles of the Kaneri River up to its junction with the Kalinadi, and a survey of the latter from this point 29 miles to Kadra at the tidal limit of the estuary. Blasting work was carried out in the Kaneri. For the improvement of the Kalinadi discharges of the river were taken and special regulation weirs were designed, and of these works alone there were 185. A Report with the complete project, with plans and estimates, were submitted by Pipe in November, 1917. The value of the work undertaken in the Kaneri River at a cost of Rs.8744 quickly became apparent. In one season alone over 800 logs, otherwise unextractable, were floated down this length of the river, their value amounting to Rs.1,12,000. The following year Mr. Pipe was appointed permanently to the Department,



ELEPHANTS FLOATING TEAK LOGS IN THE KALI NADI, N. KANARA, BOMBAY PRESIDENCY



GENERAL VIEW OF LAYOUT OF A BUFFALO WINCH, KANARA FORESTS, BOMBAY

Photo. by T. S. Pige

and an Engineering Branch came into being. At first the energies of the Branch were directed to improving the existing roads and to surveying, aligning and supervising the construction of new roads in the Southern Circle. Now (1925) its activities extend to wherever its help is needed in the Presidency. The staff comprises two Forest Engineers and a Superintendent of Government Sawmills. Most works, save purely engineering ones, have consequently to be constructed by the usual Executive Forest Establishment. It is for this reason that Pipe has standardized types of buildings and roads. Since 1919-20 increased activity has been possible. The Kanara scheme of roads is now (1925) nearing completion ; several roads of the Surat Dangs scheme are under construction and a scheme for Peint is being started. It is estimated that the length of roads and paths in charge of the Department amounts to about 11,000 miles. The Alnawar-Dandeli Railway (metre gauge) begun in 1917, partly as a war measure to facilitate the supplies to the Munitions Board, was completed in 1919. It was recently opened to passenger traffic in order to increase the earnings, which do not yet equal the expenditure. Sawmills form an important section of departmental activity. Experience in the Presidency has shown that small mills, with a daily outturn of 3 to 10 tons, and easily portable from place to place after a more or less short term of years in a locality, can be worked profitably. These mills—there are seven Government mills and two private worked on a share basis—mostly use the aftermath of large fellings, converting it into sleepers and scantlings of market or indented sizes. The Engineering Branch is responsible for keeping sawmills in order, whilst the Divisional Forest Officers deal with the supply of timber, the marketing of the outturn and the general commercial management. Investigations are being carried out by the Engineers with the object of discovering suitable mechanical appliances for the extraction of logs from the hitherto unexploited steep slopes of the Nagjhiri Valley and for solving the carting difficulty by introducing mechanical transport. Before dealing with these matters a brief account of the Utilization Circle will be necessary.

The appointment of Utilization Conservator was created in February, 1920. The Circle had a brief and ill-starred career and has been in abeyance since 1922. Mr. D. A. Thomson was appointed to the post, but his activities during the first year were limited to the heavy work of disposal of

the surplus stocks of timber and waste material in Bombay belonging to the Munitions Board, a necessary work which he dealt with satisfactorily and finally closed down. As Thomson pointed out, the experience was of value since it brought the Utilization Branch into touch with the Timber Trade in Bombay and with the brokers in the trade. Investigations into the possibility of establishing forest industries in or near forest areas were undertaken and researches into minor products commenced. An outcome of value was the opportunity taken of the visit of Mr. Rowles, a sawmill expert from home. In company with Thomson he paid a visit to the Dandeli Sawmills (North Kanara) and a Report was submitted on their condition along with plans and proposals for an up-to-date general utility mill and dry kiln. Thomson also paid a visit to Mormugao "in connection with the acquisition of land for a Government Forest Depot at Vasco-da-Gama, and, after a satisfactory interview with the Fiscal Director, proposals were submitted." This port afforded the best outlet for Kanara timber and, though in Portuguese territory, the Government approved of the proposal to form the depot. The Report of the second and last year's work of the Circle gives evidence that little progress could be made in the many investigations which awaited research work until the Conservator could give his whole time to the work and be provided with sufficient staff. A severe famine was experienced that year, and in addition to the charge of a territorial Circle the Utilization Conservator was mainly occupied with famine work. The subjects which received such attention as was possible were paper pulp, resin and turpentine from *Boswellia serrata*, destructive distillation of wood, fibres, tans, power alcohol from *mhowra* flowers and bobbins. The slump in timber values may have had some influence in discontinuing the appointment of Utilization Conservator, but in view of the advances being made by other Provinces in this direction it appears a rather unfortunate direction in which to practise economy.

Pipe wrote a Memorandum (1925) on the work of his branch, which is summarized below.

In order to deal with the forest road work, both as regards new construction and the improvement of existing communications, it was realized that standardization of types of roads and drainage works were essential, particularly as the works would be scattered and the restriction of the Engineering Branch to the minimum



A GLIMPSE OF ONE OF THE FEEDER NALAS OF THE NAGJHIN VALLEY IN THE NORTHERN KANARA DIVISION, BOMBAY PRESIDENCY, WHICH IS BEING WORKED BY MECHANICAL MEANS BY THE FOREST ENGINEERING DEPARTMENT. A LENGTH OF THE EXTRACTION ROAD CAN BE SEEN ON THE RIGHT-HAND SIDE NEAR THE TOP OF THE PICTURE

Photo. by T. S. Pipe



TEAK LOG WEIGHING 3 TONS BEING HAULED UP A STEEP SLOPE OF 55° FROM THE VALLEY BELOW IN ORDER TO GET IT ON TO THE EXTRACTION ROAD. THE LENGTH OF THE HAUL IS 1,200 FT.

Photo. by T. S. Pipe

an essential. For this reason a complete set of standard type plans and estimates for drainage and earth works, dams, causeways and bridges has been prepared. These range from drains of $1\frac{1}{2}$ by $1\frac{1}{2}$ feet to timber top bridges of 20 feet height and 24 feet span. For some of the larger works complete standardization is impossible. The system evolved is original, and the object in view was to produce plans, etc., which would be complete, simple, and suitable for use by men who are not trained engineers, such as Divisional and Range Forest Officers.

The actual field work was confined in the beginning to the Northern Division of Kanara. At present the scope of work includes all the most important Divisions of the Presidency. Up to 1925 over 200 miles of road, often in difficult hilly country, had been aligned and surveyed by the Engineering Department. In addition, other existing forest roads, amounting to over 400 miles, had been inspected, checked and corrected, and advice and assistance given in connection with repairs, improvements, drainage works, checking of estimates, etc. Several special works had been surveyed and designed, and one large causeway, costing Rs.75,000, was constructed by the Engineering Department over the Kalinadi. It appears permissible to express a doubt whether works of this magnitude, if really required, should be financed by a Forest Department. In most countries, and even provinces in India, their construction and payment would fall to the Public Works Department. Roads are classified as (a) those required as parts of definite exploitation schemes, and (b) those required for general convenience of administration, combined with the object of facilitating exploitation. Of the former, one road through difficult country brought in a net profit of Rs.13,000 during the first year of its use, and it is said will give a net profit of Rs.10,000 annually in the future. Another road paid for itself in the first season. Of roads of the second class a road is being constructed in continuation of the Nasik-Goldari Road through South Peint, Dharampur State, Daman State to Udva in North Thana, whence a road runs to Sanjan on the coast. The central portion through British and Dharampur State territory has been surveyed and is under construction. The Portuguese Government have agreed to construct the length through their territory at their own expense. There are valuable forests which will be opened in this part of Peint. It is said that at present there is scarcely even a cart-track. With this road constructed, contractors from Thana and Nasik will be able to come in and the value of the coupes will rise. The anticipated net revenue from this road is estimated at Rs.1,15,200 per annum perpetual.

The possibility of building light railways and tramways has received consideration; also the use of tractors. The difficulty of the latter is the objection of the Public Works Department to the

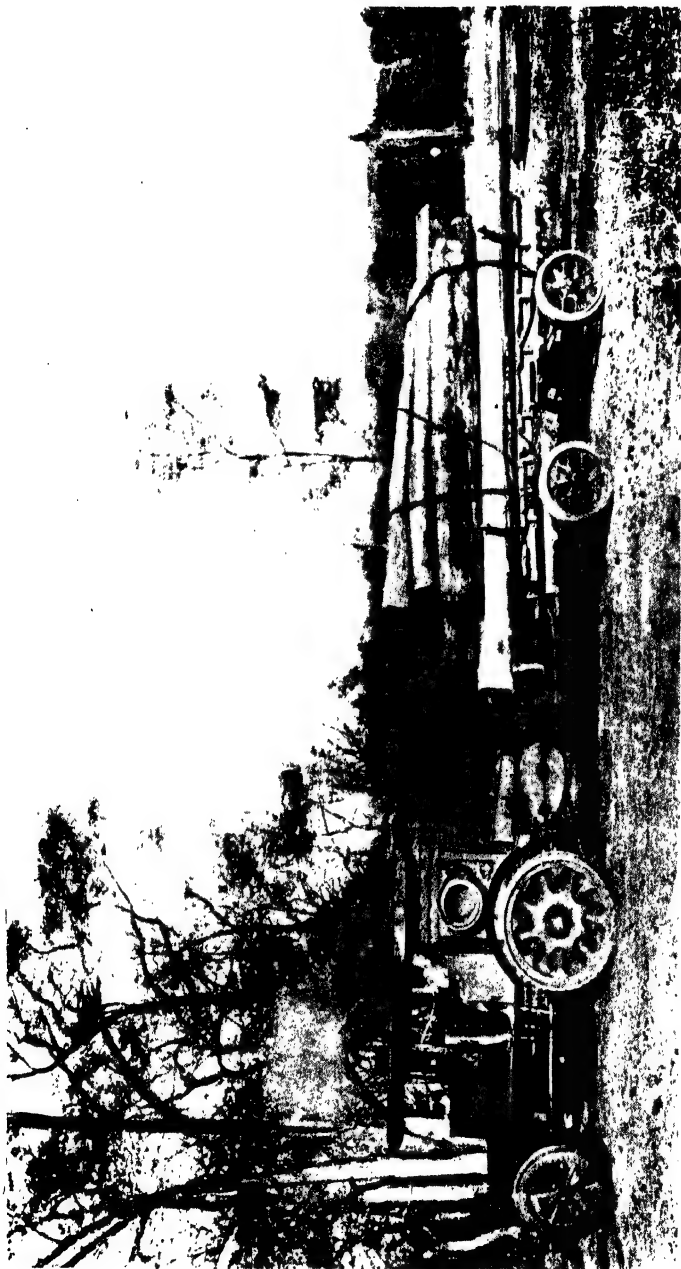
use of heavy tractors over District roads. On this subject Pipe writes: "After exhaustive enquiries a Foden Steam Tractor and an 8-ton Dryson Trailer were purchased. The speed maintained was low and all the wheels were rubber-tyred. This outfit has worked through one fair season and is now in its second year. Certain mechanical difficulties have had to be overcome. It has been engaged on sleeper transport for the M. and S.M. Railway contract over a run of thirty miles. Running costs have been kept to an anna, and for the last year they showed a slight advantage over bullock-cart transport. Experience so far has shown that such mechanical traction is quite feasible, but careful supervision and systematic organization are of course essential." Other experiments are being carried out in the same direction, and the manufacturers of the Sentinel Steam Tractor are undertaking (1925) a three months' trial under Forest conditions. In connection with transport, the possibility of ropeways has been considered for these localities, one on the bi-cable and the other on the mono-cable system. "The scattered nature of the areas," says Pipe, "has again been the stumbling-block, as concentration of traffic is an essential for ropeways as economical and paying systems. The usual methods adopted in America, Australia and Europe are not feasible for India. These have to be modified and sifted, and even the details of the machinery require modification, practically in all directions."

The exploitation of the teak forests of the Nagjhiri Valley in Northern Kanara, both with mechanical and animal power, has been commenced. For the former, a Fordson Tractor with a special skidding winch is used. An extraction road had been constructed a few years previously, so that with that and tracks on the upper ridges the entire hill-side of the valley is within reach. This power winch is now in its second year of work and appears to have given unqualified success. The cost of extraction is low, amounting to between Rs.6 and Rs.10 per ton. The outfit has been working up to a range of 1500 feet and methods are now well organized. Up-to-date this season (1925) this outfit has extracted timber of value of more than Rs.40,000, which could scarcely have been extracted by previous methods. Bullock or buffalo winches have also been introduced. Two were purchased from America. These are not primarily intended for logging work but have been adapted. One is now working its second season and is proving admirable for the work. It is being worked departmentally by Forest Establishment, and already during the present season has extracted timber of the value of Rs.28,000. This type of machine requires certain modifications which, it is said, will make it almost ideal for the use of contractors for heavy timber extraction work. Accurate accounts are maintained, so that the exact skidding costs can be calculated. The exploitation of the upper part of the



SHOWS THE LOADING OF LOGS ON TO A STEEL TRAILER AT THE TEMPORARY DEPOT AT THE HEAD OF THE VALLEY. THE APPARATUS USED CONSISTS OF A GUY-DERRICK. THE BOOM IS CAPABLE OF SWINGING COMPLETELY ROUND THROUGH 360° . HOISTING IS DONE BY MEANS OF A MAN-POWER WINCH ATTACHED TO THE CENTRAL DERRICK-POLE. LOGS ARE ALSO DRAGGED UP TO THE WINCH BY MEANS OF THIS WINCH AND TACKLE, WHICH OPERATION CAN BE SEEN IN THIS PICTURE.

N. KANARA, BOMBAY



SUPER-SENTINEL STEAM TRACTOR LEAVING THE TEMPORARY DEPOT WITH A LOAD OF LOGS WEIGHING ABOUT $5\frac{1}{2}$ TONS. THIS IS NOT THE LIMIT OF THE HAULING CAPACITY OF THE TRACTOR, BUT THE LOAD OF LOGS IS AS MUCH AS CAN BE SAFELY ACCOMMODATED ON THE TRAILER FOR TRANSPORT OVER ROUGH ROADS. THE TRACTOR IS EQUIPPED WITH REDUCTION GEARING, CHAIN-DRIVERS AND WEIGHS ABOUT $7\frac{1}{2}$ TONS READY FOR THE ROAD. THE WHEELS HAVE SPECIAL RIMS SO THAT STEEL OR SOLID RUBBER TYRES ARE INTERCHANGEABLE. N. KANARA, BOMBAY

Nagjhiri Valley is to be the project for the next few years, followed by the lower length, which will involve road construction in advance.

In connection with the organization and maintenance of stores a depot has been formed at Dandeli for engineering, logging and mill materials. This is being developed into a Central Stores for all surplus plant and machinery and as a distributing centre for consumable stores to all the sawmills of the Presidency. Indirectly connected with it a workshop and foundry are maintained. In connection with the sawmills already alluded to two types of seasoning sheds, of 125 and 250 tons capacity respectively, have been designed. Already seven of these have been erected, or are in the course of erection in various parts of the Presidency, and are said to be proving most successful.

THE UNITED PROVINCES

To a certain extent the modern history of exploitation, etc., in the United Provinces is associated with the formation of the Utilization Circle, the first to be constituted in India. Allusion has already been made to the fine exploitation works which were commenced nearly forty years ago in the Himalaya in the form of slides, sledge roads and so forth (p. 138 *ante*). The expansion of these as required on up-to-date lines has continued. The main interest of the period centres around the Utilization Circle and its activities, for the example so set by the Province has had a wide repercussion in India. The far-reaching aims of the Circle have received much criticism and have resulted in a considerable financial loss to the Province, a loss which to some extent is directly attributable to the inflated ideas on the subject of a great trade revival which followed the close of the Great War and were by no means confined to India, either in Government or commercial undertakings. It seems not improbable that in this great expansion in a far-seeing forest policy, even though it has met with a severe check, perhaps an unavoidable check, the future historian of the progress of Indian Forestry will point to the United Provinces as having given a much-needed lead in the introduction of methods by which a serious effort was made to market other species than the handful which had for so long ruled the markets, and which several generations of officials had been content to regard as the only products of value in the Indian forests. In addition, its work has resulted in the inauguration of industries such as the bobbin factory, which would never have been initiated by a private company. The Utilization Circle has been correctly defined as the commercial branch of

the Department and its aims are the investigation and development of the uses of all the products of the forests, and the undertaking of such action as may be necessary to enable Government to obtain the full value for the same.

It has already been said that the enormous demand for forest produce during the War and the great increase in the revenue led up to the formation of the Utilization Circle. India had to be self-supporting and Mr. (now Sir Peter) Clutterbuck, at the time the first Chief Conservator in the Province, threw himself with great energy into the business. An extensive Estate was acquired at Mahespur Utaria, about 5 miles from Bareilly, for various industrial schemes of the Department. In order to co-ordinate this work, which envisaged the erection of sawmills, a bobbin factory, a resin factory and so forth, the Utilization Circle was proposed to the Government of India in May, 1918. The reasons given were the need for developing to the utmost the United Provinces Forests and the steady rise in the revenue since 1899-1900. Scope for development was indicated in resin and turpentine, grass for pulping and the less-known timbers and other industries dependent on forest produce. The work to be placed in charge of the Circle was: (1) The new resin distillery near Bareilly then under construction. (2) The sawmill at Sitapur, which had carried out remarkable work during the War and was to be transferred to the site near Bareilly. (3) The Forest Utilization Officer and the Wood Working Institute, Bareilly, which was transferred to the Forest Department from the dual control of the Education and Industries Department. (4) The Forest Engineer. The Government of India sanctioned the formation of the Circle from October, 1918. Already, in July, 1918, the complete plant for a bobbin mill had been purchased and, on the formation of the Circle, the establishment of this mill was placed under the Conservator of the Circle. The great energy and initiative of Clutterbuck were at the back of this new departure, and the conditions of the time must be borne in mind. The forest resources of the Province were being strained to the utmost and everything produced found a ready market. The small Sitapur sawmill worked full time, the demand for bobbins was acute and mills were driven to accept unsatisfactory articles from Japan. The forest surplus revenue rose by leaps and bounds, attaining the record of 29.1 lakhs in 1917-18; the gross revenue rose from 31.3 lakhs

in 1914-15 to 61.1 lakhs in 1917-18. A trade revival was anticipated not only in the United Provinces but throughout the world, and industrial enterprises of all kinds were expanding in anticipation. In 1919-20 the Circle comprised the four charges: (1) The Wood Technology and Wood Working Institute, Bareilly. (2) The Sawmills and Turnery. (3) The Resin and Turpentine Factory. (4) Forest Engineering, all situated at Mahespur. Subsequent developments in the Circle were the formation of a Timber Supplies Branch in 1921, to act as an agency for attracting purchasers for the various timbers and to arrange for the supplies of wood for the mill and factories at Mahespur, which had been now renamed Clutterbuckganj, in honour of the founder. Present-day opinion considers that the layout of the various establishments at the new town, which included houses for the European experts and Indian staff, a post office, hospital and so forth, was on an excessive scale; but all over the world present-day ideas are far removed from the optimism which swayed a world, wearied of war, in 1919-20. Extensive sales continued and the Conservator of the Circle was deputed to visit and study the resin industry and wood-working concerns in America, England and France. Large sums were spent, which, though mainly provided from revenue, were essentially capital expenditure, the returns for which it was considered would be recouped later. It will be understood from the foregoing that the Department had definitely embarked on an undertaking of a commercial nature with the object of demonstrating that sawmills and factories, in other words, industrial undertakings, based on the supply of materials from the forest for the most part until comparatively recently unsaleable, could be made to pay. Mr. F. Canning, the Conservator of the Circle, in a Memorandum kindly written for me in 1925, based on one drawn up for the Legislative Council of the Provinces, says: "Meanwhile our gross revenues continued to expand until 1920-1, though this expansion is partly to be discounted by the payments made by the Utilization Circle for produce received from other Circles which resulted in increases in provincial totals of both expenditure and revenue." In order to ascertain the financial position of the concerns under the Circle the accounts were submitted to a firm of Chartered Accountants and drawn up in commercial form. While the accounts of the Resin Factory showed comparatively satisfactory results those of the Saw-

mill and Turnery audited at the end of 1921 gave rise to grave apprehension. The facts were placed before the Legislative Council and the subject was fully discussed at the Budget Debate of March, 1922.

Canning describes the action taken as follows : " It was intimated that our idea was to put the concern in a somewhat more attractive condition and then, if opportunity offered, to dispose of it by sale. During 1922 further investigation of the prospects of the Sawmill and Turnery was carried out. The greater experience of the Conservator, after deputation as already explained, and of the staff recruited from England, helped in placing the position more clearly before Government. It appeared that the rules and restrictions unavoidable under existing Government procedure must be removed if financial success was to be obtained in what otherwise appeared a promising proposition. Such a change not being possible, the only alternative was to cut the losses and if possible make over the undertaking to private enterprise, although under such circumstances the undertaking being still incomplete and hitherto financially unsuccessful, and trade conditions being at the depth of a slump, a low value for our outlay could only be anticipated. After due consideration by the Forest Advisory Board it was decided that the Sawmill and Turnery and the Turpentine and Resin Factory should be made over to private syndicates for promotion as limited liability companies, in which Government would take shares at the purchase value, the preliminary negotiations to be undertaken by the Utilization Conservator subject to confirmation by Government.

In regard to these negotiations, the guiding principle maintained was that the companies should be started on a reasonable capital valuation basis that would, as far as could be forecasted, ensure their ability to pay reasonable dividends from an early stage of their existence. Government's interest in these concerns was not limited merely to the actual value that it received for making them over to public shareholders, but also to the valuation and terms being such that success should be attained with the accompanying benefit to the shareholders and to commercial enterprise generally."

I had the opportunity of visiting these factories in May, 1925, and the managers very kindly showed me every detail. It may be stated that they appear to compare favourably in methods, efficiency, and in outturn with the most up-to-date works of a similar character to be seen in Europe. Government had of necessity to write off considerable sums, and the factories were then floated as companies. The capital of the Indian Turpentine and Resin Company was fully subscribed. The Indian Bobbin Factory was reorganized, and is now considered to be making headway and to be turning out under the expert European staff as good a product

as is obtainable elsewhere. Success is anticipated, and this success will have a far-reaching effect in establishing in India the manufacture of components required in large quantities by the great milling industries hitherto entirely dependent on imported articles. It would not serve any historical purpose, nor will space permit, to deal with the somewhat complicated accounts of this great venture. In order that the magnitude of the enterprise undertaken may be appreciated, the total figures for the period are quoted. The Grand Total of Receipts from the various concerns for the financial years 1918-19 to 1924-5 amounted to Rs.46,11,560. The expenses for the same period were Rs.1,02,48,395 and the deficit Rs.56,36,305.

The Government had in hand the buildings and, perhaps of far greater importance, the knowledge that a definite start had been made in the direction of more intense exploitation of the forests, not only in their own province, but throughout India; lastly, the certainty that a considerable portion of the sums spent had gone into the pockets of their people—especially in Kumaun.

A word may be added on the subject of the Wood Technology and Wood-working Division. This consisted of the Government Central Wood-working Institute at Bareilly, and is an educational and experimental concern which could not be expected to be remunerative. It increased in capital value by 8 lakhs during its tenure by the Forest Department and has now been handed back to the Industries Department. This Institute formed the first stage in the work of the Circle in respect to developing the uses of timbers. New uses were sought for timbers at the time inadequately utilized and new timbers available in the forests in commercial quantities but so far not exploited were sent from the Forest Divisions and tried out in various ways. The Institute is situated at Bareilly, the centre of an extensive furniture-making industry, largely of a cottage nature. It was natural that timbers should be largely tried for furniture, for which the supplies of timbers hitherto used were becoming deficient. The class of furniture produced at Bareilly has been materially improved as a result of the instruction in designing and construction and of the experimental work. Much work in joinery was also done. In this way the use of Asna (*Terminalia tomentosa*) was much developed in India for panelling; a specimen panelled room in this timber in the office was a large factor in deciding the use of the timber in constructional work at new Delhi. The early experimental work that led to the starting of the Bobbin factory was all done at this Institute. Much development in the use of coniferous timbers was promoted. Thus all the ballot boxes for the elections under the Reforms in the Province were successfully made here at short notice from *chir* pine. Constant enquiries were received for help from various industries, such as turnery of all kinds, boot lasts, leather-cutting blocks, brush backs, casks. Standardization and promotion of machine tool work was also

carried out and many firms were provided with trained artisans. The local industry was helped with machined standard parts of furniture. One new company using machinery for furniture work came into existence largely owing to the Institute's activities in this direction. Kiln seasoning was also taken up, the Institute having the first kiln operating in India and doing much useful work. The educational activities of the Institute were at the same time fully maintained and expanded, and this was of great benefit to the Department. The period of financial stringency in the Province coinciding with the introduction of the Reforms, and the large capital expenditure on the Sawmill and Bobbin Factory led to a demand from Council for reduction of expenditure on the Institute. It was further suggested that such reduction would be better obtained by re-transfer of the Institute to the Industries Department. The Forest Department before transferring arranged for reductions which brought the net annual cost down to under $1\frac{1}{2}$ lakhs, but the concern was transferred to the Industries Department and thus came under popular control, as this Department is a transferred subject. The latter point was the guiding factor as, if desired, the costs could have been still further reduced whatever Department was in control.

Since the transfer the Institute has again become little more than an educational establishment, and research in the uses of the provincial timbers has ceased. I had an opportunity of visiting this establishment in company with the manager, in May, 1925. I was greatly impressed with the efficiency of the work shown me and with the surprisingly good educational advantages the Institute affords. An examination of the students was taking place, and I would wish to place on record the eminently practical nature of the tests demanded of the students. As Canning has well shown, the work achieved by the Institute in the past was of the highest value. I had recently studied the work being carried out at the Research Institute at Dehra Dun. I was consequently the more impressed with the great possibilities and the great potential value, in the interests of the United Provinces, of the research work which, with an adequate provision of funds, the Institute could carry out. The Provinces have here the ideal of a technical college which can be combined with valuable research work. It is becoming better understood nowadays that in times of financial stringency the last budget items to cut are grants for research. It may be hoped that an enlightened and progressive body like the Provincial Legislative Assembly will find it possible to allocate funds to reinstate the Institute in the position it can fill with such credit and value.

On the subject of the post of Utilization Conservator, Canning wrote: "After a very much curtailed discussion in the course of the last Budget debate (1924-5) the Council refused to vote the necessary funds for the continuation of the Utilization Circle. The

demand had been cut down to the absolute minimum which was considered necessary to safeguard Government interests in the completion of the transactions with the Clutterbuckganj companies and to help these companies, in whose future Government was so greatly interested, to establish themselves on sound lines. The retention of the Utilization Circle Conservator was also one of the original stipulations made by the syndicate before promoting the companies. The demand had therefore to be certified by His Excellency the Governor in Council. Since then the companies have been formed and have received their legal powers of trading and the documents concerning the transfer have been practically all completed. The companies had originally agreed to reimburse Government to the extent of one-half of his pay for the cost of keeping the Utilization Conservator at Bareilly to act as liaison officer in the dealings of the companies with the Forest Department. Later in the year, as proceedings advanced the companies intimated that they did not insist any longer on the retention of the Conservator, and this arrangement was cancelled. Therefore Government proposed to the Council to hold the Utilization Circle and Conservator's post in abeyance from the end of 1924-5. It is not considered that Utilization work, as now correctly interpreted, does not exist, but the need for economy is still great, and it is proposed to employ a comparatively low paid officer, working under the Chief Conservator of Forests, to deal with this branch. Should the future prove that more active measures must be taken to retain or expand our markets for Forest Produce, proposals would be first submitted to the Council before any such steps were taken. Government proposals were accepted by Council and the Utilization Circle is now in abeyance. The Officer to help the Chief Conservator of Forests has not yet been appointed."

The following extracts from a demi-official letter (No. 312 c., dated 4th April, 1925) from Channer, who was officiating Chief Conservator for Billson, on leave, have reference to the above. Alluding to the rise in revenue after 1914-15, he wrote: "The rise was largely due to a rise in prices during the War but was considerably influenced by the intensive Working Plans, for sâl in particular, which began with Collier's plan for Haldwani Division. The main feature of the new plans was a concentrated regeneration area in the better classes of sâl and the lowering of the accepted girth at which a sound sâl tree reaches maturity from 6 feet to 5 feet. In the more recent plans the latter feature has, of course, been more scientifically worked out as a lowering of the rotation. The outturn of sâl rose from about 26 lakhs of cubic feet in 1914-15 to about 39 lakhs in 1917-18. The total outturn of purchasers'

timber rose from 49 lakhs of cubic feet to 92 lakhs. This was largely due to the enormous output of *chir* sleepers for military purposes. These sleepers were available because of the big pre-war contract with the N.W. Railway for 10 lakhs of open-tank treated sleepers to be supplied in four years from 1914-15. This contract came to a premature end owing to the impossibility of getting the creosote."

In connection with exploitation generally in the Province the policy at present is to avoid departmental work. Chakrata (in the Himalaya, II, pp. 306, 335) is an exception. It was found that the system of selling standing trees here was not a success. As long as the prices of standing deodar trees were fairly constant, as was the case before the War, the plan was successful. When the prices of this timber and of blue pine and *P. longifolia* began to jump about (after the War) the contractor bought at high prices, took two years to get his material floated out, to find prices fallen and himself ruined. Further, contractors buying coupes in this fashion could not afford to build wet slides and so forth. A five-year contract was therefore entered on with a firm under which the latter undertakes the exploitation work and acts as sales agent at Jagadhri on the N.W. Railway. The Department pays rates, fixed upon by agreement, for the extraction of each piece and the firm credit the Department with the gross revenue. In addition the firm receives a percentage (at present 20 per cent) of the difference between the gross revenue and the cost of extraction. Their present manager in charge of the work is an Extra Conservator of Forests, part of whose salary they defray. Under this arrangement the Department insist on every coupe being worked out whether the material is saleable or otherwise, and consequently the Working Plan prescriptions are carried out. The system is excellent since the Department is in fact in control. Channer is of opinion that the system should be extended to Kumaun, where the departmental working of the *Pinus longifolia* has not proved a success. The fuel supplies for the Chakrata and Lansdowne military cantonments are worked departmentally. There is little profit in these operations, and where troops are concerned the risk of contractors not fulfilling their undertakings cannot be run. Resin is extracted departmentally and sold to the Resin Company. In other Divisions the system in force is sale of standing trees in the prescribed coupes of the year.

Whilst in the Haldwani Division opportunity was taken to examine the new 2-foot-gauge tramline which had been just completed (1925). The Divisional Officer furnished a note on details. The line connects with the R.K. Railway at Lalkua Junction and, traversing Reserved Forests all the way, terminates above Chorgallia, where the Mandhaur River debouches from the hills, a distance of $15\frac{1}{2}$ miles. Extensive forests up the Nandhaur River are to be heavily worked for the next seven years, and the tramline is designed to reduce the cost of extraction from these rather inaccessible forests, and also to facilitate the working of all the forests between Lalkua and Chorgallia, through which it runs. It is estimated that the tramway will easily repay its cost. The total sanctioned capital cost is Rs.1,81,000. Construction was commenced in November, 1924, and the line was to be in working order by November, 1925.

From the earliest days of the working of the forests by the British the methods of extraction, the form in which the produce should be extracted, and the methods on and by which the royalty prices should be realized, have passed through several transitional stages with the advance in forestry progress made in a Province. In the United Provinces, prior to 1896 there was a double line of export *chawkies* (to be found in several other provinces at this period and much later, even to present times) and a fixed royalty rate list. This system was superseded by the Lump Sum one. The gambling connected with the latter is a chief drawback and a compromise between the Lump Sum and the outturn system, known as the Monopoly and Royalty system, was introduced. The purchaser pays a proportion of the royalty by a lump sum bid at auction, and the remainder on a schedule of rates on passing export and check *chawkies* (toll stations). This system reduced gambling, but did not ensure a perfect clearing of the coupe. In 1912 it was sought to improve on this system by what was called the guaranteed Minimum Outturn system. The Divisional Forest Officer announced at auctions the estimated outturn of the coupe, and if the outturn proved less a refund was made to the purchaser of a portion of his bid. The defects of this system are obvious—either the Divisional Officer had to face constant applications for refunds or the guarantee was placed so low that Government incurred a loss. As regards the most modern developments in this connection, Channer writes as follows :—

“ Experience in exploiting the forests of the Sarda Valley in the Haldwani Division, which could only be exploited by using the Government tramline, has led to experimenting with a third

system. The conditions peculiar to the Sarda Valley were that it must be worked by reliable purchasers with plenty of capital who could and would work the forests thoroughly in a short time. Selection of purchasers and not the chances of an auction was essential, and the royalty, too, had to be fixed by agreement and not by competition. All the royalty was taken at the export *chawki* at a fixed schedule of rates. This led to attempting a similar system after holding an auction. The majority of the timber goes out under a certain class in the schedule of rates for which the rate was 8 annas per cubic feet. The bidding goes in pies above this rate. The rates for all inferior classes are fixed and the rates for all superior classes remain at 2 annas, 4 annas, 6 annas, etc., more than the rate for the 8 annas class. This system, of course, does away with all gambling due to uncertainty of volume of timber available. Its main drawback is that although the purchaser may have made a perfectly reasonable bid, giving him, say, an all-round profit of 3 annas per cubic feet on the average, he will have a tendency to export only the superior timber on which he is actually getting a large profit and to leave the inferior timber on which he may be getting a very small or possibly no profit. Another point of interest which must be mentioned in connection with timber sales in the United Provinces is that of sleeper supplies. The Department now obtains before the auctions large orders from all the principal M.G. lines in Upper and Central India, announces at auctions that each lot must supply so many sleepers at the given price, passes the sleepers, and in the case of the foreign railways loads and despatches them. The railways place credits at the disposal of the Divisional Forest Officer and he pays the purchasers. The purchasers have an assured market for a considerable portion of their outturn and no trouble about wagons. Early payments from the railways enable the purchasers to finance the remainder of their outturn without borrowing money, and if the railways are somewhat late in paying, the Forest Department, having control of the money, are enabled to give purchasers credit for their second and third instalments, to meet which, under other conditions, purchasers nearly always have to borrow money. This system is obviously of great advantage : (1) To the railways who can obtain an assured supply of sleepers at a reasonable rate with practically no trouble. (2) To the purchasers, and (3) to Government. The system was initiated originally on a small scale by Sir P. H. Clutterbuck, more for the purpose of being on good terms with the R. and K. Railway, which moves most of the outturn of the Province, rather than for any actual increase of revenue to Government. The essence of the system is a good understanding between the departmental and the railways about price."



THE OLD STYLE AT CHANGA MANGA. COUNTRY CART DRAWN BY TWO PAIRS
OF BULLOCKS. CARRYING CAPACITY 200 CUB. FEET STACKED
Research Institute, photo.





TYPE OF ENGINE USED ON THE CHANGA MANGA 2 FT. GAUGE TRAMWAY.
PUNJAB

Photo. by W. E. Flewett, 1925

The most usual system of disposing of coupes in France is to divide them into lots of varying size and then sell the latter at a public auction. This latter is held by the Conservator in the presence of the Mayor, or his deputy, of the town in which the auction is held. The bills contain a description of coupe with its situation, routes of export of material and the estimated amount of material of various classes the coupe contains. The Department takes no responsibility for the correctness of the estimated amounts, and the French Forest Officer and Guard tell you that the timber contractor is usually capable of forming a shrewder estimate of the latter than the Forest Officials themselves. The bidding is by the Dutch auction system. The Conservator fixes upon the sum to start the auction with and the amount by which the drop should be made. A Brigadier (Forest Ranger) then shouts out the price, dropping by the sum decided upon till one of the persons present signifies his acceptance. A reserve price is fixed, and should this be reached without offer the lot is withdrawn. The advantages of the method are obvious. Whilst at an auction of Allapilli timber being held by Dickens at the Depot at Ballarshsh in March, 1925, I suggested to Farrington, the Chief Conservator, who was present, that this method of auction should be tried. One good lot was reserved till the end and put up in this way. Not a single bid was received. An old contractor announced that the method was new to them; they did not understand it and preferred the old way. Naturally! Bidding was bad that day and markets were bad owing to trade depression. But it may be suggested that the Dutch auction method, once efficiently introduced, gives the truest index to the real price of a coupe since collusion amongst bidders is very difficult.

THE PUNJAB

Up to about the year 1907 the exploitation of the forests in the Himalaya was mainly departmental. Mr. Fisher, when he became Conservator, altered this into sale of standing timber to contractors, because he considered that silvicultural work was the primary duty of the Forest Staff, and if the work of that staff was concentrated on exploitation, silvicultural tending of the forests would be neglected—as in fact up to that time was common throughout India. The contractors' system continued up to the War (1916-17) and

was then, with the sudden large calls from the War Department, inevitably replaced by the departmental system which was made fully applicable in 1920 and continues to date. Mayes, the Chief Conservator, writes : " The staff is both more numerous and better trained now than in Mr. Fisher's time ; and the chances of silviculture being neglected is small. The present-day Working Plans make a point of it."

In a paper read before the Punjab Forest Conference in 1922 Mr. Grieve, then Chief Conservator, pointed out that the Department was faced with the marketing of far larger quantities of timber than it had to deal with under the old system and, as a result, would have to bestir itself to develop new markets and to devise methods of handling its increased stocks more expeditiously and economically. In order to accomplish this object two important changes were in progress, namely, the recent introduction of the method of raising loans to provide for forest capital expenditure, superseding the former practice of finding it from surplus revenue, and the financing and working of forest schemes through the agency of a co-partner, who puts up the necessary capital wholly or in part. The working of the two projects now brought within the latter, namely, the resin concern and the proposed Hora Sawmill, would be watched with interest, both by Government and by the Trading Community as a whole. At the Conference in question it became plain that the Department had realized the fact that it paid best to get out the timber to mills and depots in the log form and that, apart from the Working Plans, deemed indispensable before working on a large scale could be undertaken, to enable large inaccessible areas to be opened out would entail the construction of roads, slides, flumes, ropeways, river works, booms and seasoning sheds on a scale which hitherto had never been contemplated.

In a letter (No. 1661, dated 30th October, 1919) to the Revenue Secretary, Punjab, on the subject of the inadequacy of the Forest Staff, Mayes, then Conservator of the Eastern Circle, dealt with the proposal to form a Utilization Circle as follows : " In the other great section of Indian Forest Research, Forest Economics, co-operation with the Central Institute at Dehra Dun, backed up by local effort, is no less important. Co-operation with the United Provinces and Kashmir State is also most important ; while present arrangements appear adequate to obtain co-operation in Chamba



A TELESCOPIC SLIDE, LOWER BASHAIR, N.W. HIMALAYA, 1921

H. M. Glover, photo.



WORKING LOGS DOWN A ROLLING ROAD IN
UPPER BASHAHR, N.W. HIMALAYA, 1921
H. V. Glover, photo.



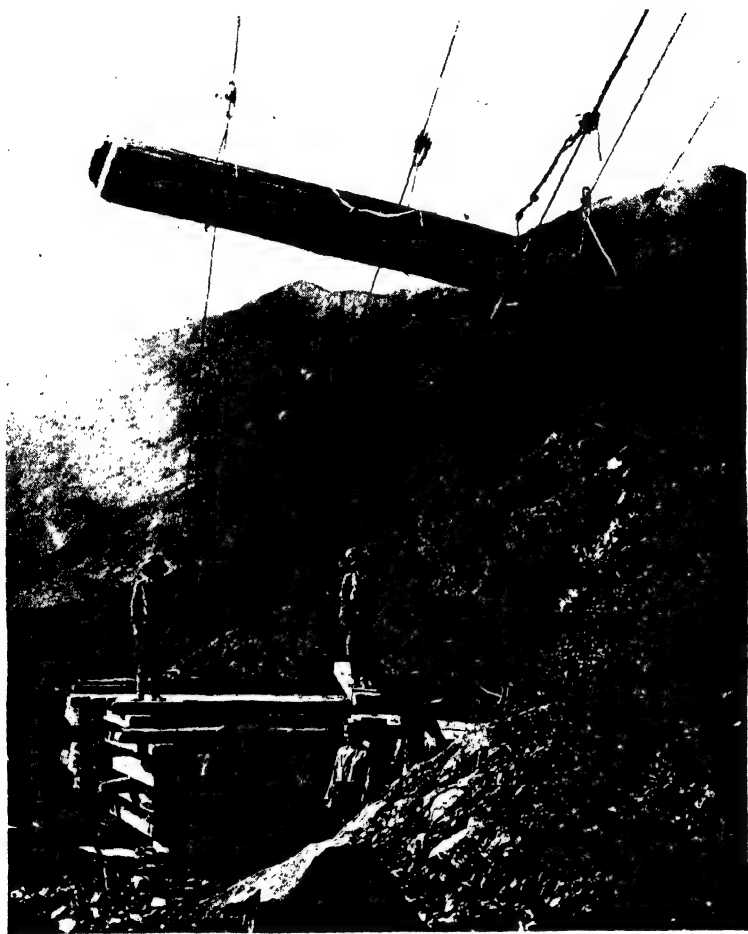
A LOG SLIDE BELOW RUNANG FOREST, UPPER BASHAHR, N.W.
HIMALAYA, 1918-19
H. V. Glover, photo.

State, and the North-West Frontier Province. The study and inauguration of pioneer industries, involving expenditure of considerable capital and a good deal of careful organization, is local work of sufficient magnitude to justify the appointment of a whole-time Senior Officer with the rank of Conservator. . . . The territorial Conservators in charge of the Eastern and Western Punjab Circles will be able to carry out their duties for some little time to come even with the suggested reorganization, but the constitution of a third Circle of Administration, the Utilization Circle, is a matter of imperative necessity and cannot be well delayed, as on the success of this Circle depends much of the development now foreshadowed. The Circle will have as its primary duty the development of the forest resources of the Punjab. It must therefore of necessity start at nearly zero point, for, so far, outside its ordinary line of supplying lumber and firewood the Punjab has only the Jallo Resin and Turpentine Factory to show as an example of its industrial enterprise; but even so the organization in marketing the timber, in grading the timber to the best advantage and in studying new enterprises and so on, will involve much preliminary spade-work. As schemes mature the Utilization Executive Staff can be enlarged, but as the staff will be almost entirely extra-departmentally recruited the question of cadre need not be discussed here. It may be remarked that the principle of Utilization Circles has been accepted, *vide* letter No. 546, R. & A. Forests, dated 5th September, 1918, to the Chief Secretary of the United Provinces." The Utilization Circle was formed in February, 1921.

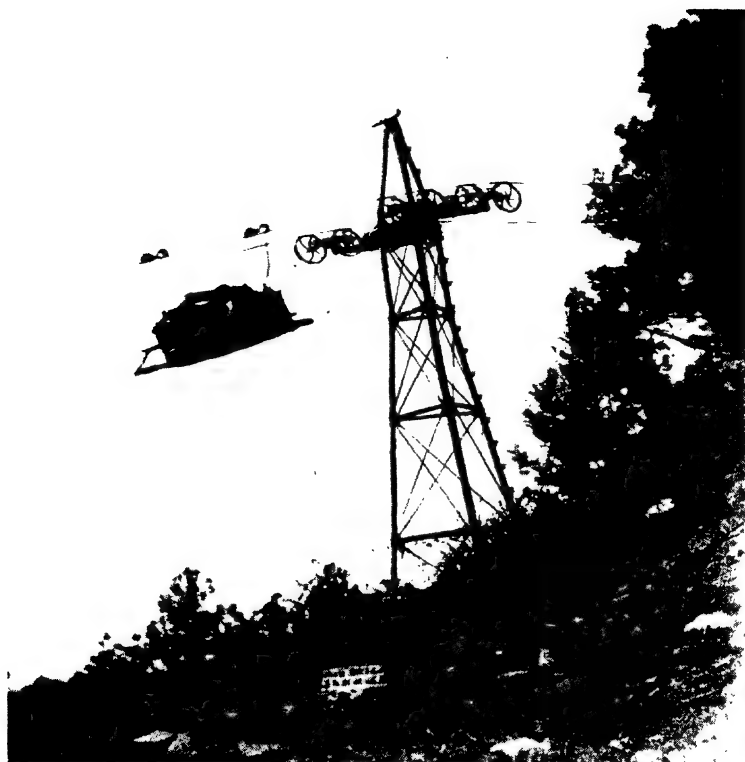
The development of departmental operations in the Provinces is discussed by Mr. H. M. Glover, Utilization Conservator, in a Memorandum written in 1925. For previous articles on the subject by this officer reference may be made to the *Indian Forester*—"Fifty Years of Forest Administration in Bashahr," November, 1915, March, 1916; "Lumbering in the Upper Sutlej Valley, Punjab," November, 1919, April, 1920.

In 1919 Mr. Martin (now in Madras) visited Bashahr and drew up schemes for the exploitation of fir forests in log form by means of slides, etc., the logs to be extracted and sawn up at rail head in the plains. A large capital expenditure was involved and the schemes were postponed in 1921. In 1920 and 1921 extensive extraction of hand-sawn spruce and silver

fir sleepers for the N.W. Railway was undertaken and by 1922 large stocks of sleepers were ready in the forest. The contracts for sleepers expired in 1922 and were not renewed, a monopoly being given to a private firm. Prices were seriously affected and the Government incurred a serious loss with apparently little chance of recovery in this respect till the monopoly expires in 1927. The outturn, which amounted to over a lakh of cubic feet of finished products, dropped to 340,000 cubic feet in 1924, consisting chiefly of deodar and blue pine. Between 1921 and 1925 many wire ropes were erected, enabling remote forests and areas on steep slopes to be worked. These ropes are all worked by gravity and are based on a system patented by Mr. C. H. Donald, from whom patent rights were acquired (see Plate). About thirty spans are in operation, a span being about 3000 feet in length, an average of 450 sleepers being passed down in a day. The greatest span erected is 4500 feet in length and 2500 feet in vertical height between the terminals. In Kulu departmental operations were in force till 1903, after which the trees were sold standing till 1919 when departmental work again supervened. Here again large quantities of fir were extracted between 1919 to 1921, the work coming to an end as in Bashahr. The forests were examined by an American engineer in 1920 and a sawmill was purchased in America to convert logs. With the drop in demand for fir the mill has not been erected. The methods of extraction are the same as in Bashahr. In Rawalpindi the forests consist of *Pinus longifolia* and are situated in the foot-hills. Scantlings are sawn in the forest and carried to markets in the plains by camels and bullocks. There is a large demand for fuel for the troops at Murree, and this is supplied by a ropeway. A description of the Patriata ropeway is given in the *Indian Forester* for November, 1913 and 1925. It may be noted that since the ropeway was erected the costs of bullock transport have risen about 100 per cent, and it would have been quite impossible to have extracted sufficient firewood had the ropeway not been in existence. It is of interest to note that this ropeway was inspected by General Sir Gerald Kitson, Commanding Rawalpindi Division in 1913, and that plans were forwarded to the military authorities with the result that a similar ropeway 40 miles in length and driven by Diesel engines was erected in the Khyber Pass for military transport.



THE GRAVITY ROPEWAY (DONALD'S PATENT) IN USE IN UPPER BASHIAHR,
N.W. HIMALAYA, 1921
H. M. Glover, photo.



ROADS AND BUILDINGS

In a preceding volume (II, pp. 521, 522) the progress made by the Department in the construction of roads and buildings was alluded to. At the end of last century the North-West Provinces held the lead in this respect, possessing a good set of roads, especially in Oudh, and good rest houses for touring purposes. The subordinate staff were also fairly well housed. The progress in many of the other Provinces was, however, sadly deficient, and remained so until well on in the present century. The close relation existing between the opening out of good communications, involving a considerable expenditure, and the expansion of revenue had not been adequately appreciated at the time the War cloud burst over Europe. The lessons learnt during the War and the more common use of the motor-car have resulted in a great improvement. To the consistent increase in the revenues from the forests and a more enlightened recognition of the strenuous work and life of the Forest Officer may be attributed the considerable improvement in housing accommodation which the last decade or so has brought about in most of the Provinces. The present position in different Provinces will be briefly considered.

Bengal.—The only Divisions fairly served with *Roads* are Darjeeling, Kurseong, Jalpaiguri and Buxa. The roads to some extent perhaps are being improved owing to the use of the motor-car as a means of transit for officers. The rest of the Divisions are still backward in this respect. As regards *Rest Houses*, the same four Divisions, with the addition of Kalimpong, are well provided, tents being rarely employed for touring. The houses are *pakka* in the Darjeeling Division, but wood in the other cases. The Chittagong Divisions are not as yet well off in this respect, the old cane *basha* or hut being the principal accommodation available. As regards the subordinate staff Rangers and Guards are now said to be fairly well housed.

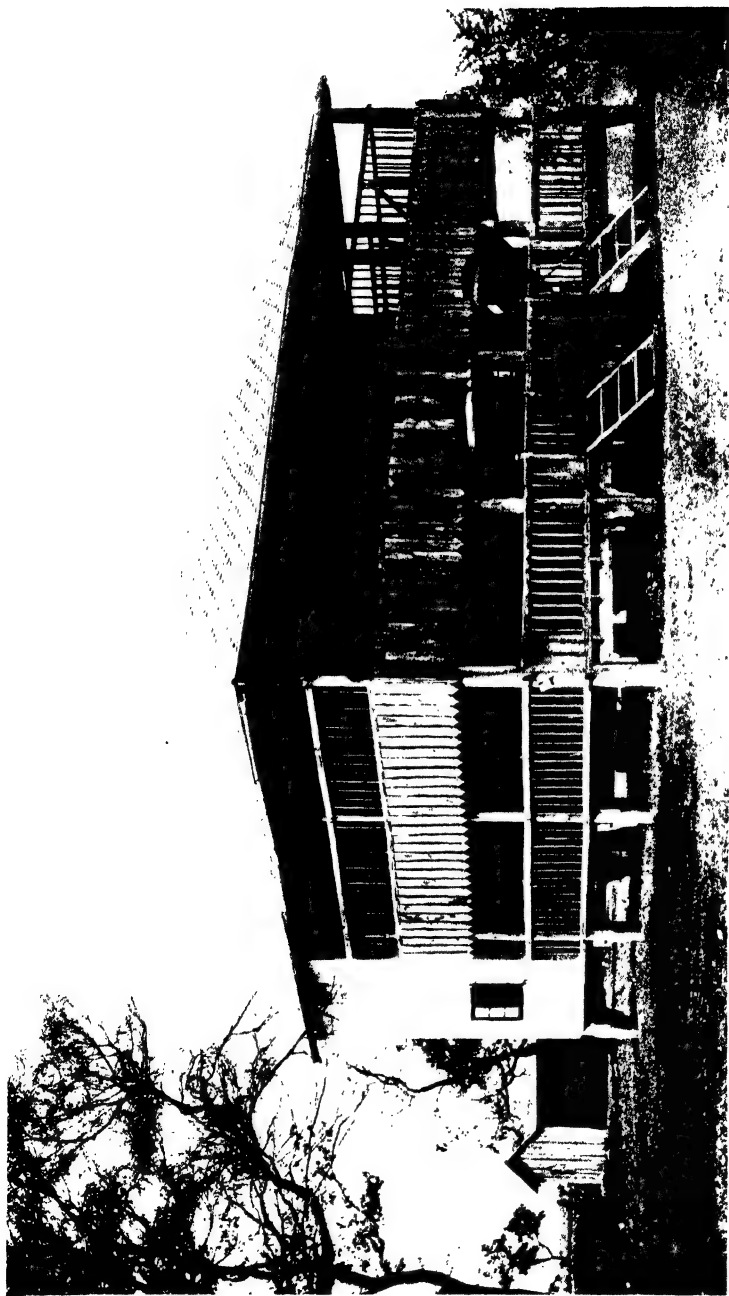
In the Quinquennial Review for 1919-24 the following account of the progress made appears: "Good progress was made during the period in constructing roads with a view to opening up some of the less accessible forests. Considerable attention was also paid to providing the staff with suitable quarters. The average expenditure during the present and previous periods is compared as follows:

	Period 1st July, 1914, to 30th June, 1919.	Period 1st July, 1919, to 31st March, 1924.
Roads and bridges . . .	24,365	42,940
Buildings . . .	39,467	77,296
Other works . . .	6,574	7,851
Total . . .	70,406	128,087

For the first period the expenditure was just under one-twentieth of the gross revenue; for the latter a little over one-sixteenth."

Assam.—Generally speaking Assam is very badly served by *Roads*. Cachar and Kamrup have been opened up to some extent. Goalpara is the Division in the Province which has an excellent road system. This was first amplified by Perree, who cut the forest into blocks by lines one mile apart. G. N. Simeon converted the lines into *kutchas* roads in order to be able to use a motor-car, he being the first officer to introduce one into the division. Many of these have since been bridged by H. P. Smith. I ran over many of these roads in a car in company with Meiklejohn, Divisional Officer, during my recent visit. On the new section of the tramway between Kochugaon and Fakiragram, built over established cultivation, every stream, forty-five in all, on the 17 miles, had to be bridged, including the big work over the Hel River already mentioned. The work was commenced in January, 1923, the first loaded train running in March, 1924. The *buildings* have also been improved, a type of corrugated iron-roofed building having replaced the old thatched bamboos or reed-walled huts which now only commonly exist in localities which the officers do not often have to inspect. Goalpara has made the greatest advance in this respect. Kochugaon, where there was only a mud hut for the use of the Divisional Officer at the beginning of the century, and Hultugaon having now reached the position of stations with a number of well-built bungalows for the Forest Staff, and other amenities, the latter even having street lighting! H. P. Smith is responsible for much of this fine work. The daily life of the Forest Staff has been revolutionized by amenities which were too long delayed.

In 1920 the accommodation at both places was very poor. Since 1920 the following were erected at Kochugaon: (1) Saw Sheds (Rs.550); (2) Dispensary, remodelled (Rs.650); (3) New Office (Rs.2,500); (4) New Post Office (Rs.1,800); (5) two Rangers' quarters (Rs.2,000 each); (6) two Foresters' quarters



JAMGURI REST HOUSE, TYPE OF A 1ST CLASS HOUSE. RUNA DIVISION, BENGAL.



THE GOALPARA FOREST TRAMWAY. A TRAIN OF LOGS EN ROUTE TO
FAKIRAGRAM ON THE NEW SECTION OF THE LINE. 1925

Mrs. H. P. Smith, photo.



TYPICAL TIMBER-TOP BRIDGE, 16 FT. HIGH AND 15 FT. SPAN. A TYPE
DESIGN OF THE FOREST ENGINEERING DEPT., BOMBAY PRESIDENCY

T. S. Pipe, photo.



THE HEL BRIDGE FROM ON TOP. H. P. SMITH, L.E.S., THE BUILDER, WITH MR. B. C. DAS, E. A. C. FORESIS. THIS BRIDGE HAS 11 SPANS OF 30 FEET APIECE. GOALPARA, ASSAM

Photo. by Mrs. H. P. Smith



KOCHUGAON FOREST BUNGALOW, BUILT IN 1906 AND SINCE IMPROVED.
KOCHUGAON IS THE HEADQUARTERS OF THE FOREST TRAMWAY. GOALPARA
DIVISION, ASSAM

Mrs. H. P. Smith, photo.



(Rs.1000 each) ; (7) Guards' quarters, two Barracks (Rs.750 each) ; (8) Mahouts' Sheds, two (Rs.650 each) ; (9) two Coolies' Sheds (Rs.650 each) ; (10) Engine Driver's quarters (Rs.500) ; (11) Club-room for subordinates.

Burma.—This province, which has always depended upon its waterways for the extraction of teak, has paid little attention to the construction of *Roads*. In a note supplied by the Chief Conservator the subject is commented upon in the following terms: "Up to now (1925) there has been very little organized expenditure upon roads, but with the increasing importance in extraction of species other than teak the question of making the forests accessible by good extraction roads is becoming more and more important. It is hoped that we shall shortly frame a Provincial scheme for main roads and be allowed to put this through with the help of loans." As regards *Buildings* Burma has advanced in one respect further than some other Provinces in making provision for housing accommodation for the officers stationed at Headquarters. In the past the Divisional Officer and his Assistants had to make their own arrangements, as was usual for most civilian officials throughout India, the bungalows available being often of the poorest description with disproportionate rents. The Headquarters houses are now built by the Public Works Department, and the chief complaint heard in various parts of India in this connection was that the cost of construction was unnecessarily high, the rent based on this cost being in consequence excessive. Since the Government has a direct interest in the officers retaining their health, and a good house is a great aid, it might be suggested that a fixed rent based on a percentage of salary, irrespective of the original cost of the house, would be a wiser method of assessment. The rest houses and accommodation for forest subordinates are built by the Department. The Chief Conservator says: "The position as regards housing is very uneven; in some Divisions it is good and in others there is practically no housing accommodation for the staff. The type of house is satisfactory."

Bihar and Orissa.—This Province, or the Forest Circle, is chiefly composed of Divisions formerly belonging to Bengal. These were mostly very poorly off in both roads and forest buildings, a parsimonious policy in this respect having for long held sway, doubtless accounting for much of the sickness amongst the staff. The present position is as follows: In the

Singbhum divisions a number of *Roads* have been built ; these, though poor in quality and type, are sufficient for bullock timber transport. It was suggested that a tramway should be built by the Bengal Timber Trading Company. The Consulting Engineer, sent down by the Government of India to report on the project, expressed the opinion that it would not pay, as owing to the hilly nature of the country the line would have to be constantly shifted. In Angul and Puri Divisions the roads are fair, whilst in the rest they are inferior to bad. As regards *Housing* accommodation there are now Government Headquarters bungalows for officers in all Divisions. The construction of rest houses has also received attention. For instance, in the old days when I joined in Singbhum from home tents for touring were almost universally used. There are now twenty rest houses in Saranda and Kolhan alone and eight in Porahat. The Goilkerā *pakka* rest house was the only one in existence in these three Divisions in 1894. The Sambalpur Division (formerly belonging to the Central Provinces) is very badly off for rest houses. A programme for remedying this defect both here and in other Divisions has been drawn up and the necessary buildings are being constructed. A programme for dealing with the housing of the subordinate staff has been drafted and the Conservator states they "are building better quarters by degrees." The housing of the subordinate staff in the old Bengal was a scandal for a long period, and from the above it is apparent that even now it is only being dealt with in a somewhat half-hearted fashion. For half a century the subordinate staff of the Forest Department in most parts of the country received inadequate pay and were badly housed. Can the inefficiency so often attributed to this staff be wondered at, given the conditions of forest life and work in India ? The expenditure during 1922-3 on communications and buildings amounted to Rs.1,45,029.

Central Provinces.—The forests in these Provinces appear to be in most cases fairly adequately provided with cart tracks, and the problem to be faced is to improve these tracks by building a better type of road along them, and when necessary metalling it. Soon after Farrington's appointment to the Chief Conservatorship in 1922 he drew up a Memorandum at the instance of the Revenue Member, giving "some concrete examples of actual results as regards improvement in the revenue line from increased expenditure." On the



TAUKLEYAN FOREST REST HOUSE, PROME DIVISION, BURMA

Photo. by A. Rolger



CHANGA MANGA FOREST HOUSE, PUNJAB. BUILT 1871

subject of *Roads* he wrote as follows : " During the financial years 1912-13 and 1913-14 Government allotted a special grant of Rs.25,000 for the construction of roads in the Hoshangabad Division. The attached statement gives the roads constructed for Rs.24,762.12.0 out of this grant. Subsequently certain sums have from year to year been spent on further road work and revenue has steadily increased and more than repaid the outlay as will be seen from the Divisional figures given below :

Hoshangabad.	Timber.	Fuel.
1912-13 . . .	42,790	6,484
1913-14 . . .	66,271	8,113
1914-15 . . .	69,058	6,351
1915-16 . . .	88,052	13,793
1916-17 . . .	131,456	19,244
1917-18 . . .	148,410	27,785
1918-19 . . .	94,143	19,564
1919-20 . . .	214,895	43,109
1920-1 (9 months) .	169,571	14,965

At page 5, para. 7, of Chief Conservator's Review on Circle Annual Reports, 1913-14, the following remark will be found : " It is reported by the Conservator, Southern Circle, that the opening out of the forests in the Balaghat Division by the construction of forest roads since 1907 has resulted in a considerable rise in revenue as is proved by the fact that the revenue in one of the Ranges of this Division during the year was Rs.30,000 against Rs.8,000 in 1907." Annual Report, 1918-19, para. 9 (a), page 3. " Again money invested in roads is certain to come back in increased receipts and that this is the case may be gathered from the following tabular statement of a number of roads recently constructed which have resulted in higher prices being paid for the timber exploited by their agency.

Roads.	Cost.	Revenue.		
		Before construction.	After construction.	
<i>Northern Circle.</i>				
Maharaji-Girod . . .	5,764	4,009	8,047	
Kewradih Ghat Road . .	894	1,160	3,150	
Dugli-Jawarra . . .	1,867	11,500	13,500	
<i>Berar Circle.</i>				
Karwani-Sonarbadī . . .	696	6,000	7,000	
Nanda-Bhainsdehi . . .	25,650	6,000	18,000	

For several years past it has been emphasized in the Annual Reports that the value of forest produce depends entirely on its accessibility and that the policy of pushing on the construction of export roads is one that cannot be too strongly supported; it is a known fact that money spent on roads could scarcely be better invested as it is certain to come back in increased receipts. It is not economical to sell, e.g. sâl timber where extraction roads are inferior." The Chief Conservator's remarks need no endorsement. They are truisms in European Continental Forestry.

Buildings have been much neglected in the Province. Divisional Officers still chiefly use tents on tour and a considerable number of additional rest houses require to be built. There is also apparently a great deal still to be done in improving the accommodation of the subordinate staff. In some Divisions the housing is very good, in others very bad. New construction is also said to be required for the expanding staff. Under this head the Chief Conservator writes (*An. Report*, 1923-4, p. 10): "Another defect of administration that awaits remedy is the shortage of accommodation for all classes of the staff, especially for gazetted officers attached to Divisions and for the Forest Guard; the progress made during the last quinquennium has not sufficed, but with our increased revenues in evidence matters should now improve." For the quinquennium ending 1923-4 the average annual expenditure on communications and buildings amounted to Rs.2,26,758 against Rs.1,78,430 in the preceding quinquennium. In addition, Rs.1,13,531 were spent on roads in 1921-2 out of famine funds and Rs.42,911, and Rs.84,299 in 1922-3 and 1923-4, respectively, out of loan grants.

Madras.—With some exceptions the Presidency is very much behind in the construction both of *Roads* and *Buildings*, especially in good accommodation for subordinate officials. Between 1901-25 the total length of new roads constructed was 5669 miles at a cost of Rs.15,93,443 or an average of about Rs.281 per mile. It becomes obvious that but little real progress in opening out communications for the extraction of big produce could be made with so infinitesimal an expenditure.

It has been already shown that the last few years have witnessed an awakening in Madras and that the Forest Engineer Officers who now have this matter in hand are

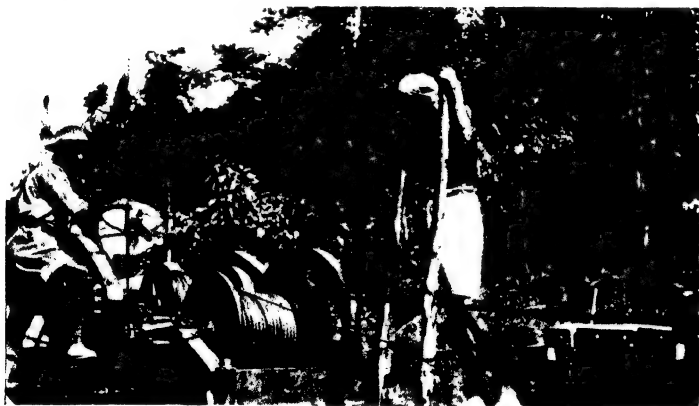


ROAD CONSTRUCTION IN THE SAPPAL VALLEY, PAUGHAT DIVISION. DRY STONE REVETMENT 141 FEET LONG BY 41 FEET
HIGH. 1925. MADRAS

Major W. F. Chipp, photo.



LOGS OF *MESUA FERREA* BEING YARDED ON TO ROAD. SAPPAL VALLEY,
PALGHAT, MADRAS *W. F. Chipp*



NO. IV. SKIDDER YARDING LOGS IN DHONI VALLEY. EVERGREEN FORESTS,
CHENAT NAIR, PALGHAT, MADRAS *W. F. Chipp, photo.*



engaged on the laying out and construction of roads which will vie with the best existing forest roads in India.

The total sum spent on buildings during 1901-25 was Rs.20,04,580 or Rs.80,183 per annum. In 1901-2 the gross revenue amounted to Rs.25,43,430, while the annual average for the quinquennium 1919-20 in 1923-4 amounted to Rs.52,25,383. In the light of these figures it will be apparent that the expenditure on roads and buildings in the Presidency has been absurdly inadequate, with the resulting inevitable stagnation in revenue results. In a quarter of a century the Madras Forest revenue failed to double itself.

Bombay.—Allusion has already been made in this chapter to the *Roads* of the Presidency. The capital value of forest *Buildings*, after allowing for depreciation to end of March, 1924, amounted to almost 11 lakhs of rupees. Buildings have been greatly improved by the Engineering Branch. Standard type plans have been prepared for all kinds of establishment quarters and all combinations of the same. These have been prepared for three different kinds of construction, viz : stone and lime, brick and lime and laterite and lime. These include quarters for Guards, Foresters, Clerks, Range Forest Officers, Subdivisional Officers, bungalows, offices, dharmshalas, wells, etc. This set of standard designs and estimates for departmental buildings comprises over 100 separate works and is said to cover all ordinary requirements. As regards larger works a structure designed and constructed recently is a large fodder grass storage shed at Palghar. The shed is of steel throughout and cost Rs.40,000. Mention may also be made of the Dandeli Forest Depot. A few years ago there were no buildings there except huts. The buildings erected now consist of offices, bungalows, quarters for the staff and workmen, a dispensary, school and a stores depot. There are also railway quarters, water supply tanks and stand pipes, etc.

United Provinces.—In a previous volume the fine record of these Provinces in regard to *Roads* and *Buildings* was detailed (II, pp. 521, 522). This record was maintained during the earlier years of the present century. The Chief Conservator kindly gave me the following details concerning the present position. "Although a very great deal has been done in connection with the *Forest Roads* of the Province lack of funds which has been chronic in recent years has greatly hampered the work of keeping existing roads in repair and in the construction of essential new roads. As regards

Buildings the financial stringency of the last few years has resulted in the buildings throughout the Province falling into a bad state and prevented the construction of new buildings, especially required for housing the large increase of new staff which is now employed in the intensive working now in force. This has spoilt the fine record of the past, when the United Provinces were *facile princeps* in this respect. The new Councils have a tendency to starve the Reserved Departments and to spend the money on the transferred ones." Yet I heard the same complaint in Bombay where the Forest Department is a transferred subject! The average annual expenditure on communications and buildings during the quinquennium 1914-15—1918-19 amounted to Rs.3,45,707; for the quinquennium 1919-20 to 1923-4 the average figure was Rs.7,37,049. The increase was almost entirely due to the construction of the factory buildings at Clutterbuckganj. In both cases works such as wells, compound walls, etc., are included.

Punjab.—For some time past the Punjab has been provided with fairly good *Roads* and *Buildings*. The fact that for a considerable period the chief source of revenue came from the hill forests necessitated the provision of communications and the erection of housing accommodation since camping in mountains is difficult for various reasons. The Chief Conservator considers the position as regards roads and buildings in the Province at the present day to be fairly satisfactory. "Every year new additions are made whenever necessary." The following figures show the expenditure incurred during the years mentioned upon roads and buildings respectively: 1900-1, Rs.9,971 and Rs.20,064; 1904-5, Rs.11,141 and Rs.17,016; 1909-10, Rs.57,585 and Rs.30,302; 1914-15, Rs.46,205 and Rs.69,533; 1919-20, Rs. 49,919 and Rs.57,475; 1923-4, Rs.34,492 and Rs.42,103.

The total expenditure on roads during the twenty-four years was Rs.11,09,507 and on buildings Rs.10,08,318, or a grand total of Rs.21,17,825. This amounts to a little under one-twentieth of the gross revenue realized during the twenty-four years, which came to Rs.4,96,53,717.

The record of the activities of the Department under the work detailed in this chapter exhibits the considerable advances which are being made in the introduction of up-to-date methods of extraction. The work is as yet in its infancy. But the



THE RALLI ROAD UNDER CONSTRUCTION, 1921. THIS ROAD WAS BUILT BY THE FOREST DEPARTMENT AND RUNS UP THE GORGE OF THE SUTLEJ RIVER, UPPER BASHAHR, N.W. HIMALAYA



CAVE SUPPOSED TO BE INHABITED BY A DEMON TO WHOM GOATS WERE SACRIFICED BY THE COOLIES. THE DEMON WAS SUPPOSED TO BE THE CAUSE OF ALL THE FATAL ACCIDENTS INCIDENTAL TO THE CONSTRUCTION OF THE

factor which dominates the situation and which is no longer open to dispute or question, even by the most timid of Finance Departments, is the actual proof afforded that money spent in opening out communications, whatsoever the type considered suitable by the experts, is a sound financial policy. The case of buildings is in a different category. Omitting the strongest reason, the humanitarian, it is good business to house the staff well since a man in sound health is obviously capable of undertaking more and better work than one incapacitated by fever, etc. That this truth is well recognized in commercial circles is evidenced by the standard of accommodation provided for their staffs by the great commercial concerns engaged throughout the East. From my own personal observations during 1925, though a great advance has been made over conditions existing fifteen to twenty years ago, a great deal would still appear to be required—especially for the subordinate staffs. For the slackness exhibited in the past the various Governments are not solely to blame. We ourselves, every Conservator and Divisional Officer who has served in India, have to shoulder a portion of it. It may be suggested that this grave stigma on the Service, in so far as action is possible, should be removed (*vide* Sec. of State, Sir C. Wood and Duke of Argyll's opinions on this subject, II, p. 123).

Note.—Allusion has already been made in this chapter to the appointment of a Forest Officer to the Railway Board. Since going to press Mr. R. G. Marriott has kindly written as follows: "In 1923-4 the Railway Board arranged for an enquiry to be made by Mr. F. W. Allum, I.S.R., and Mr. R. N. Parker, I.F.S., into the sources of supply of wooden sleepers, and the methods of purchase; also into the possibility of reducing the cost of sleepers, of using substitutes, and of making direct arrangements between the Railways and Forest Departments for the supply of sleepers. The report of this 'Sleeper Enquiry Committee' contained several recommendations, among which were the establishment of sleeper treating plant in certain Provinces and the holding of formal conferences from time to time, between the Forest Officers and Owners and the Chief Engineers of Railways in different parts of India, to discuss arrangements for sleeper supply and such questions as the price of sleepers, the number likely to be available under Working Plan prescriptions, etc. About the same time, the Railway Board appointed Mr. H. G. Norman White, of the Indian State Railways, with headquarters at Dehra Dun, to investigate the possibility of making more use of Indian timbers, other than teak, for railway carriage building. His report recommended, among other things.

that practical trials should be made of a number of timbers after seasoning, and if necessary preservation treatment, by the Forest Research Institute. The recommendations made in these two reports could only be put into effect by co-operation between the Forest Research Institute and the Forest Departments of the Provinces and States on the one hand, and the Railway Board and Railway Administrations on the other. It was therefore decided that a Forest Officer should be lent temporarily to the Railway Board to act as a kind of liaison Officer between the two departments." It was to this post that Mr. Marriott was appointed in May, 1925.

CHAPTER XXI

ON THE PROGRESS OF THE YIELD AND REVENUE FROM THE FORESTS, 1901-25

PERHAPS no single factor in the progress of Forest Administration in India is so striking as the continuous rise in the revenue from the forests since the first introduction of conservancy some sixty years ago. The most notable point in connection with this steady increase is the fact that every reorganization of the staff, coupled with grants made for opening out communications and so forth, has been followed by an upward leap in the revenue.

It is only in comparatively recent times that a more liberal policy has been followed, and even now, as this history clearly demonstrates, considerable reluctance is evinced in some quarters to make adequate grants. This is now a matter resting with the various Legislative Councils. It may be hoped that an appreciation of the proved fact will induce them to vote the Departmental budgets in a liberal spirit, since the grants may be regarded as certain revenue-producers, so long as an expert staff is in charge of the Department.

Preceding chapters will have furnished abundant proof that the statement above formulated is beyond criticism. It is proposed to give here a brief record of the upward progress made in yield, revenue and expenditure, reviewing more especially the various aspects of the yield from Minor Products.

INDIA, INCLUDING BURMA

Yield of Produce.—The progress in the outturn of timber and firewood (major produce) from all sources, i.e. Govern-

ment Agency, Purchasers, Free Grantees and Right Holders, is shown for the years given in the following table :

Year.	Timber. cubic feet.	Fuel. cubic feet.	Total. cubic feet.
1899-1900	54,055,324	100,036,069	154,091,393
1903-4 . .	61,392,968	171,153,674	232,546,642
1908-9 . .	64,409,894	167,625,971	232,035,865
1913-14 . .	97,225,170	197,418,153	294,643,323
1918-19 . .	91,516,140	252,806,778	344,322,918
1923-4 . .	110,219,035	244,315,129	354,534,164
1924-5 . .	*(a)	*(a)	*(a)

The upward trend of these figures is striking ; but the out-turn is still far below the yield capacity of the great Forest Estate. For all classes of forests the yield for 1923-4 only represents in cubic feet per acre a fraction of the future possibility of the Forest Estate. The general introduction of better Working Plans and more intensive management, necessitating the provision of adequate funds, will yield far higher results.

An interesting departure made towards the end of the War was the appointment of Messrs. Martin & Company as Agents to the Government of India for the sale in Calcutta of timber worked out departmentally from the Andamans. The services of this firm was also at the disposal of any Local Government who desire to make use of them. Messrs. W. W. Howard Brothers & Company of London were similarly appointed sole agents for the sale of Government timber in Europe. It is too early to say what direct value this departure will have to the Conservator and Divisional Officer. With the great trade depression a longer period of trial will be necessary.

The value of the Minor Produce removed from the forests of the country has increased considerably since the close of last century ; in some cases commercial factories having been established in the country whose raw products come from the forest. In spite of the great advances made in various branches of forest administration, which have had a direct bearing on the rise in the revenue returns, the Minor Products side of forest utilization, if a few articles are omitted, has only so far been touched upon, even at the Dehra Research

* (a) Figures not available at time of going to press.

YIELD AND REVENUE FROM THE FORESTS 619

Institute. The difficulties in connection with the provision of funds at the Institute and in the Provinces are fully recognized, but is there a single thoughtful Forest Officer in India who does not feel that there must still lie untouched, because uninvestigated scientifically, a great source of revenue to be exploited. Robertson of Burma started this line of investigation at Dehra Dun and it was then dropped. In view of the great possibilities before such research it may be suggested that the Branch at Dehra, when formed, should be a separate one apart from, and not overshadowed by, the existing Economic Branch.

In the past the articles of Minor Produce from the Indian forests yielding the greatest revenue were, and are still, bamboos and grazing and fodder grass. Other articles being lac, resin, cutch, myrobalans and so forth. The values and amounts extracted from the forest of some of these latter have increased considerably during the present century; they will be considered in greater detail later on.

The value of the Minor Produce extracted from the forests by different agencies (Government, purchasers, free grantees and right holders) is shown for the years given in the table below:

Year.	Bamboos.	Grazing and Fodder Grass.	Other Minor Produce.	Grand Total.
	No.	Rs.	Rs.	Rs.
1899-1900 .	156,498,025	—	36,28,378 (b)	36,28,378 (c)
1903-4 .	198,284,244	—	44,77,484 (b)	44,77,484 (c)
1908-9 .	180,276,021	—	69,38,743 (b)	69,38,743 (c)
	Rs.			
1913-14 .	13,05,553	63,81,109	31,11,679	1,07,98,341
1918-19 .	16,21,424	76,39,577	49,48,267	1,42,09,268
1923-4 .	18,46,350	77,25,664	52,70,293	1,48,42,307
1924-5 .	*(a)	*(a)	*(a)	—

Revenue and Expenditure.—The Revenue, Expenditure and Surplus of the Forest Department is shown in the tabular statement below, the average annual figures being given from 1899-1900 to 1923-4 with the addition of the year 1924-5.

- * (a) Figures not available at time of going to press.
- (b) Includes other minor produce also.
- (c) Values of bamboos not included.

For the sake of ready comparison the interesting figures, given in the Quinquennial Reviews of Forest Administration in British India, of five-yearly averages from 1869-70 to 1898-9 are also shown.

REVENUE, EXPENDITURE AND SURPLUS,
1869-70 TO 1924-5

Period.	Revenue. Rs.	Expenditure. Rs.	Surplus. Rs.	Percentage of Surplus to Gross Revenue.
1869-70 to 1873-4	56,30,361	39,33,430	16,96,631	30
1874-5 to 1878-9	66,60,397	45,76,804	20,83,593	31
1879-80 to 1883-4	88,17,213	56,09,579	32,07,634	36
1884-5 to 1888-9	1,16,68,148	74,26,956	42,41,192	36
1889-90 to 1893-4	1,59,49,014	86,03,352	73,45,662	46
1894-5 to 1898-9	1,77,15,756	97,96,140	79,19,616	45
1899-1900 to 1903-4	1,96,58,421	1,12,69,486	83,88,935	43
1904-5 to 1908-9	2,57,03,161	1,41,05,829	1,15,97,332	45
1909-10 to 1913-14	2,95,99,992	1,63,72,501	1,32,27,491	45
1914-15 to 1918-19	3,71,35,114	2,11,15,102	1,60,20,012	43
1919-20 to 1923-4	5,51,70,000	3,67,10,000	1,84,60,000	33.5
Year 1924-25	5,67,44,683	3,13,12,705	2,13,12,705	

These figures speak for themselves. Attention may be drawn to one or two striking points. In the twenty years from 1899-1900 to 1918-19 the revenue rose from 1 crore and 90 odd lakhs to 4 crores and 68 lakhs, the expenditure increasing for the same period from 1 crore and the odd lakhs to 2 crores and a little under 89 lakhs, the surplus rising by nearly a crore. The figures for 1923-4 (the last year of the next quinquennium) were, respectively: Rs.5,44,91,224; Rs.3,49,30,281; Rs.1,95,60,943; and for 1924-5 : Rs.5,67,44,683 ; Rs.3,13,12,705 ; Rs.2,13,12,705.

Between the years 1913-14 and 1918-19 the expenditure rose by approximately 1 crore and 13 lakhs ; yet between the same years the revenue showed a greater increase, viz. 1 crore and 35 lakhs. A greater justification for liberality by adequate grants to the Forest Budgets could scarcely be put forward than is expressed by the above figures. During thirty years, 1869-70 to 1898-9, the revenue increase was 1 crore and 21 lakhs, the expenditure less than 60 lakhs and the surplus just over 60 lakhs. In the succeeding twenty-five years,

1899-1900 to 1923-4, the revenue again increased by nearly $1\frac{3}{4}$ crores, the expenditure by just under a lakh and the surplus by a little over 76 lakhs.

The surplus of 1918-19 represented an average of Rs. 1-8 annas per acre of all classes of forest (against Rs. 1-6 annas in 1913-14), the amounts varying from Rs. 1-2 in the North-West Frontier Province to 9 annas in Assam. In the Review of the Quinquennial Report of Forest Administration in British India (1920) the following remark in this connection is made: "That far better results are possible admits of no doubt, but additional staff, as well as improved methods of working and the expenditure of capital, are necessary if these are to be shown, and it is satisfactory to observe that this is being increasingly realized." An interesting comparison may be made between this pronouncement and the views of Sir Charles Wood (later Lord Halifax), Secretary of State in 1862. In a Despatch (*vide* Vol. I, p. 530) he wrote: "Whilst alluding to financial considerations, I will observe that, although it is of course to be hoped, and although I firmly believe that a considerable profit will be derived from these forests, when permanently placed under experienced and careful management; still, profit is not the only object to be kept in view and in the state in which many of the forests now are it may not be possible at once to obtain a revenue from them. An outlay, even, may now be necessary in many instances, and, when necessary, should, I think, be incurred. And it is another advantage of a permanent administration that it will look forward with certainty to the repayment of such an outlay in future years."

The policy enunciated by this clear-visioned and able administrator remains as true to-day as when it was penned over sixty years ago.

It may be added that the estimated value of forest produce given away free or at reduced rates in the year 1922-3 amounted to Rs. 76,58,501.

The two statements on p. 622 (*Statis. For. Adm. Br. Ind.* 1922-3) of Exports and Imports of Forest Produce from and into India are of interest. The imports, it will be noted, are all timber and wood sleepers!

THE FORESTS OF INDIA

EXPORTS OF FOREST PRODUCE

Articles of Forest Produce.	Quantity in tons of 20 cwt. In the case of teak and other timbers, cubic tons.		Valuation at port of shipment in 1922-3.	
	Average of 5 yrs. 1917-18 to 1921-2	In 1922-3	Amount.	Value per ton.
(1)	(2)	(3)	(4)	(5)
			Rs.	Rs.
Caoutchouc, raw	5,359	5,580	72,50,093	1,299
Lac { Button	414	919	46,73,788	5,086
{ Shell	15,117	19,169	9,27,92,133	4,841
{ Stick, seed and other kinds	1,280	3,713	51,85,681	1,396
Cutch and gambier	2,250	1,966	7,62,236	388
Myrobalans	55,293	72,038	74,00,512	103
Cardamoms	413	174	5,62,027	3,230
Sandal	309*	501	8,43,406	1,683
Ebony and other ornamental wood	†	†	1,65,871	..
Teak	30,334	29,196	80,13,989	274
Other timbers	4,460	3,230	3,47,642	108
Total in 1922-3 . . . .	..	..	12,79,97,378	..
" 1921-2 . . . . .	..	..	9,98,56,627	..
" 1920-1 . . . . .	..	..	10,94,79,365	..
" 1919-20 . . . . .	..	..	11,78,26,638	..
" 1918-19 . . . . .	..	..	6,78,92,745	..

IMPORTS OF FOREST PRODUCE

Year (calendar).	Imports of timber into British India, 1919-23.		Imports of sleepers of wood† for railways into British India, 1919-23.	
	Rs.		Rs.	
1919	59,940	1,10,85,379	222	29,580
1920	68,560	1,16,08,544	10,272	19,89,780
1921	60,381	91,99,142	23,681	46,78,556
1922	38,527	49,13,195	18,926	29,44,791
1923	30,427	39,75,721	29,447	39,25,249

* Average of four years 1918-19 to 1921-2 only, quantity figures prior to 1918-19 not being available.

† Quantity not recorded.

‡ Includes sleepers of Jarrah and other wood.

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The several Provinces will now be considered.

BENGAL

Yield of Produce.—There has been a steady increase in the outturn of Forest Produce, both major and minor, from Bengal as evidenced from the average annual results of the past five quinquenniums and for the year 1924-5 :

Period.	Major Produce.	Minor Produce.	
	Timber and fuel in cubic feet.	Bamboos. Number.	Other produce value in Rs.
1st July, 1914, to 30th June, 1919	20,577,000	25,532,019	2,94,233
1st July, 1919, to 31st March, 1924	22,480,000	30,882,717	3,34,739

Figures for previous years include those for districts subsequently transferred to Bihar and Orissa.

Financial Results.—The financial results of the Province have greatly improved after a considerable period of stagnation owing to the parsimony displayed towards the Department, for which in the past some Conservators cannot be altogether absolved from responsibility.

The average figures for the five quinquennial periods and for 1924-5 are as follows :

Period.	Revenue. Rs.	Expenditure. Rs.	Surplus. Rs.
1st July, 1899, to 30th June, 1904	11,97,251	6,22,934	5,73,317
1st July, 1904, to 30th June, 1909	11,46,873	6,42,572	5,04,301
1st July, 1909, to 30th June, 1914	12,97,447	6,48,342	6,49,105
1st July, 1914, to 30th June, 1919	14,53,023	6,99,352	7,53,671
1st July, 1919, to 31st March, 1924	20,45,022	11,79,256	8,65,766
Year 1924-5	24,75,529	14,27,502	10,48,027

The above statements require a certain amount of elucidation in order that the figures of the Province may be understood.

Some of the Bengal Divisions have always been noted for bamboo exploitation, the number during the last quinquennium averaging over 30 million annually, yielding a revenue in 1923-4 of over one lakh of rupees. The most interesting of the recent developments in this connection has been the erection of a bamboo paper-pulp factory at Calcutta by Messrs. Andrew Yule & Co. (All India Paper Co.), the bamboos utilized

coming from the Kasalong Range in the Chittagong Hill Tracts. The question of erecting the mill nearer the source of supply was given the most careful consideration but the arguments in favour of siting it at Calcutta were esteemed to outweigh the more obvious ones of placing it somewhere in, or close to, the Hill Tracts. Mr. R. C. Milward, Conservator of Forests in Bengal, 1921 to 1924, has kindly furnished me with the following note on this matter: "This scheme originated, no doubt, in the idea that there was a vast excess of bamboos for local markets in the Chittagong Hill Tracts (as, indeed, there is in Burma) as well as in the desire to use grasses and bamboos for paper pulp. The All India Paper Co. was therefore given a monopoly of the bamboos, excepting one species, *dolu* (*Teinostachyum Dullooa*), in the Kasalong Reserve, with a minimum royalty of Rs.10,000 a year after the first two years. The royalty is based on a rate (of perhaps Rs.1) per ton of crushed bamboo as it passes through the port of Chittagong (*en route* to Calcutta). The Forest Department, through the Conservator, retains control of the work in the forest. Since this monopoly was given it has been realized that the huge area of unclassified forests of this tract of country has been, and is being, so severely *taungya'd* (i.e. subject to shifting cultivation) on a short rotation that the supply of bamboos from them has been enormously reduced and this will lead to an increased demand from the Reserved Forests for the local supply. The firm's work has not been easy because the local labour (Chakma tribe) is poor and lazy, and the forest had not previously been opened out for regular work; and, again the firm's staff was lacking in experience of that kind of forest business." Milward is of opinion that the firm is likely to do well because even if the extraction from the Kasalong were to prove too difficult there are other sources of supply from Sylhet and North Arakan to the mill near Calcutta, and they could employ contractors to deliver the goods outside the forest limits or even purchase in the open market.

The second item of the minor produce of the forests is grass and fodder. The general position of the grazing question in India at the close of last century was considered in Volume II, pages 525-7, a quotation from Ribbentrop being given. The progress made in the protection of the forests from grazing and in the realization of an adequate revenue from the practice cannot be considered as having materially advanced in many of the Provinces, as this chapter will disclose. In

Bengal there has been some considerable improvement. The total area of all classes of forest under the Department on 31st March, 1924, amounted to 11,223 square miles. Of this area 4857 square miles were open to all animals for grazing purposes. In the Annual Report for 1923-4 it is stated: "During the quinquennium (1919 to 1924) the average number of animals grazed was 48,387, the number in the previous five years being 75,551; the average number of browsers declined from 412 to 360. There has been a considerable progress in saving Reserved Forests from destructive grazing by closure of area and protective fencing." In 1923-4 the small sum of Rs.23,930 was received from grazing, the total value of this produce, given free (Rs.20,294) or at reduced rates (Rs.14,598), amounting to Rs.34,892.

Other items of minor produce from the forests of the Province consists of Golpatta (*Nipa fruticans*), honey, wax, thatch grass, canes, Chaulmúgri (*Gynocardia odorata*) seed, ivory, royalty on elephants, long pepper, stone and "miscellaneous." The total value from these sources amounting, in 1923-4, to Rs.2,45,429. The article of greatest value was Golpatta from the Sundarbans Division, of which 5,271,957 maunds were collected, having a value of Rs.1,85,422.

As has been mentioned elsewhere in this history (II, pp. 432-40) elephants used to be caught by the Government Kheddah Department in the Province, the practice dating from pre-British times. After the formation of the Forest Department in these Provinces elephant catching was carried out in a desultory fashion. Departmental Officers captured a few by noosing and the Deputy Commissioner of Jalpaiguri undertook operations in this Division and in Buxa—the Terai and Duars Forests at the foot of the hills. Operations spread later to Angul and were restarted in the Chittagong Hill Tracts and licences were given to individuals wishing to undertake the venture. Skill was often absent and the results poor. In addition to licences departmental operations were undertaken in 1916-17 and 1917-18 in which fourteen and thirty-three elephants were captured, good prices being received. Between 1919-20 and 1922-3 a joint Kheddah was undertaken between the Department and the Bhutan Durbar. The Department also carried out operations in the Chittagong Division. Prices ruled high during these years and the Government profits were good. It does not appear from the records that due care was taken to select the right type of

licensee. Failure in this matter leads to shockingly high mortality during and after capture, and to deplorable callousness and cruelty, as is described under Assam later on. Bengal has still some magnificent stretches of elephant country and, with the Kheddah operations worked on scientific principles, there should be no danger of the elephants being decimated or exterminated.

A systematic study of the minor products of Bengal should well repay the outlay incurred.

A reference is necessary to the Veneer Factory of the Buxa Timber and Trading Company which was erected at Raja-bhatkhawa in the Buxa Division. One object of the undertaking was to enter the three-ply tea-box market. Owing to the War the supply of Venesta and similar boxes ran short and there appeared to be a great future before such a factory, it being considered that the mixed forests in the neighbourhood contained suitable timbers. The Company has, unfortunately, gone into liquidation. The layout of the factory and quarters for the management appears to have been on rather an ambitious scale—but the trade depression and inexperience may have played a considerable part. The Conservator is still hopeful of success being ultimately achieved. In 1925 I saw some beautiful three- and five-ply boards in the factory.

ASSAM

Yield of Produce.—Assam is the most backward Province in forestry matters. The first real effort at introducing a forest administration, commenced by Schlich and continued for some years, gave place to a lethargy which has persisted until comparatively recently. As regards the yield, it is stated that the chief factors against an expansion of the timber trade is the almost total absence of roads. Forests containing fine timber, but in which water facilities for floating are absent or bamboos are deficient, are said to be unworkable. For most of the valuable timbers will not float and require to be buoyed up with bamboos. The statement on p. 627 shows the average annual yield during the past five quinquenniums and for the year 1924-5.

Financial Results.—As was inevitable with the want of progress the revenue realized from the great area of the Assam Forests remained very stagnant. For the first five years of the present century the average annual revenue was Rs.6,38,584. For the quinquennial period ending 1919-20

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the average annual revenue was Rs.13,04,063. In twenty years the revenue had just a little more than doubled itself. In the last quinquennium there has been a rise resulting from more intensive working in some Divisions, notably Goalpara, the revenue for 1924-5 (Rs.24,78,756) being a record. The average annual figures for the past five quinquenniums and for 1924-5 are as follows :

Period.	Revenue.	Expenditure.	Surplus.
1899-1900 to 1903-4	5,77,303	3,92,178	1,85,125
1904-5 to 1908-9	9,13,559	5,57,719	3,55,840
1909-10 to 1913-14	11,21,321	8,18,106	3,03,215
1914-15 to 1918-19	11,98,519	7,48,003	4,50,516
1919-20 to 1923-4	15,95,844	10,08,505	5,87,339
Year 1924-5	24,78,756	13,30,854	11,47,902

The Conservator (*Quing. Rept.*, 1924, p. 9) wrote: " Up to 1921-2 there was little increase in the revenue in the last

YIELD OF PRODUCE

Period.	Major Produce.		
	Timber. cub. ft.	Fuel. cub. ft.	Total.
1899-1900 to 1903-4	24,792,074	39,921,488	64,713,562
1904-5 to 1908-9	22,248,973	34,657,573	56,906,546
1909-10 to 1913-14	28,701,069	38,656,675	67,447,744
1914-15 to 1918-19	25,088,516	41,924,906	67,013,422
1919-20 to 1923-4	34,514,000	41,084,000	75,598,000
1924-5	10,448,000	9,100,000	19,548,000

Period.	Minor Produce.					
	Bamboos.		Grazing and Fodder Grass. Value in Rs.	Lac.		Other Produce. Value in Rs.
	No.	Value in Rs.		Maunds.	Value.	
1899-1900 to 1903-4	132,446,931	1,00,425	5,20,510	11,144	22,669	15,77,975
1904-5 to 1908-9	150,080,801	1,22,222	7,58,660	40,316	1,52,236	21,71,430
1909-10 to 1913-14	162,599,065	1,97,886	12,38,413	38,847	86,774	22,58,816
1914-15 to 1918-19	144,560,770	2,18,771	29,75,547	1,034	2,168	20,68,849
1919-20 to 1923-4	147,877,936	3,35,064	16,28,997	45,508	3,09,097	25,85,810
1924-5	34,244,672	91,904	47,326	17,765	1,09,881	4,50,604

decade but a steady rise in expenditure. The latter was chiefly under B—Establishments owing to the increase in the pay of the Subordinate Staff and an increase in the number of Rangers and Provincial Staff. The increase in expenditure in the last two years is due to the cost of departmental operations, which have, however, led to a greatly increased surplus, that for the last year being the highest on

record." The backwardness of this Province, as some Assam officers recognize, is due to the fact that for years the produce was floated out from the forests, the staff being located at revenue stations and being little more than tax collectors. The difficulties of starting real forest work with a staff of this kind are well known to all of us who have tried. To some extent, as is shown even in Burma, water carriage, the cheapest of all forms of transport, may in the long run prove a serious hindrance to real development, since expenditure on roads and other forms of communication is either grudged or considered quite unnecessary. It is difficult to believe, in spite of pessimistic opinions expressed at the present day by a few, that Colonel Keatinge, the first Chief Commissioner of Assam, was wrong when he said that there should be a great future before the Assam Forests (p. 240 *ante*). Even Goalpara was to a great extent neglected till quite recently; a ten-years' expenditure on roads based on surveys carried out by Forest Engineers would almost inevitably see an upward trend in the revenue. To talk of an excess of Imperial Service Staff at the present day in a Province where Working Plans are almost non-existent is an admission that the lessons in progress to be learnt in other Provinces are either unknown or not understood; page 10, *Quinq. Rep.*, before referred to "the number of sanctioned Imperial Officers including Conservators is twenty-two, but the number is now regarded as excessive owing to the low intrinsic value of the greater part of the Assam Forests." One of the two Conservatorships is in abeyance and the number of Provincial Officers and Rangers is in excess of the sanctioned scale. All recruitment for the Province will, says the Report, be stopped for the time. No progress would appear possible whilst opinions of this kind prevail. A strong staff is necessary owing to the notorious unhealthiness of the Province and a liberal expenditure for development.

An interesting development in the Province is the sleeper cutting. This was commenced in Goalpara in 1923-4, part of the work being done departmentally. In the Garo Hills the work started in 1921, and in three years to 1924 a total of 31,263 sleepers (B.G., M.G. and specials) were prepared, the surplus profit being calculated at Rs.1,26,403. In Kamrup sleeper operations commenced departmentally in 1920 and were carried on for three years, about Rs.48,600 being realized. In 1923-4 the trees were sold to contractors at scheduled rates, the amounts received by Government being less than under de-

partmental working ; this is commonly the case, but the future forest crops are thereby assured since the Divisional Forest Officer has more time to attend to his professional duties.

Ply wood had been made by the mills in Upper Assam, but very small quantities of the Surma boards were available for panelling Government House, alluded to on page 382 *supra*.

Under minor produce the present century has witnessed considerable changes. There was a time when rubber formed the chief article of minor produce and received much care and attention (*vide pp. 240-242 supra*). Its importance in the Province has entirely disappeared, and with it the value of the rubber plantation, on which so much money and attention were spent, even well on into the present century. As regards grazing, the startling step has been taken of transferring the receipts from grazing to Land Revenue instead of Forests. In how many cases was a similar procedure adopted in various Provinces in India half a century and more ago. Almost without exception the policy was seen to be a mistake. And yet Assam took this, surely retrograde, step as recently as 1921-2. In that year the revenue from grazing dropped accordingly from Rs.3,41,499 (received in 1920-1) to Rs.14,304. In the former year the position was to some extent retrieved from the revenue point of view by the introduction of a royalty on lac. There appears to be considerable future possibilities about the cultivation of this product. The royalty first imposed in 1922-3 brought in a sum of Rs.1,51,873 in that year and Rs.1,64,358 in 1923-4.

Another minor product (although derogatory to term it a "minor" one) is the elephant ! If Assam is backward in some branches of forest administration she is in the forefront in the matter of capturing and training wild elephants, and to her everlasting credit she has introduced humane methods in this training business, thus replacing the barbarous and cruel procedure which has been for so long in force. Callousness and brutality of the most revolting nature were the essence of the methods, the animals being tied round the neck with cords, which eat into the flesh, for long periods, and goaded with spears. Once this procedure had been placed officially on record Sir Nicholas Beatson Bell, the Chief Commissioner, took action by revising the "Elephant Hunting Rules" and making the "Cruelty to Animals" Act applicable to the whole of the Province. The credit for this action is due to Mr. A. W. Milroy, Deputy Conservator of Forests. During his early career in the

Province he had occasion to be actively engaged in the work of training wild elephants and he was able to prove that both capture and training could be carried out on humane principles, whilst at the same time drawing public attention to the existing methods under which so high a proportion of captured animals died. The Assam Government did not maintain a Kheddah establishment. The Departmental Kheddahs are carried on under the share system, whereby the men who build the stockades and actually catch the elephants, the owners who supply the *koonkies* (female tame elephants employed) and Government which supplies the raw material and the supervision, all share in the profits on an agreed basis. At Milroy's suggestion the Chief Commissioner agreed to his conducting operations on the lines he advocated on a large scale for two seasons (from 1921) in the North Cachar Hills, where the work was notoriously difficult on account of the shortage of fodder. The wild elephants are auctioned as soon as they arrive at the depot and the purchasers are responsible for the training of their own animals. Under the new arrangement Milroy's training methods were to be in force and the officer in charge was responsible for seeing that they were carried out—in other words, that mercy replaced brutality and callousness. It was customary for customers to deposit earnest money for each elephant bought and to pay the balance after training, the more astute usually bolting if they saw that the elephant purchased was going to die under the cruel old-time treatment. 419 elephants were caught during the two years, out of which 367 were trained, 38 were released and 14 died in the forest, either big males in musth (i.e. temporarily mad), who had to be shot in the stockades, or small elephants killed by others in the stockades before they could be got out. The following, by Milroy, is witness to the success of his methods: "There was a scene of much lamentation after the first batch had been auctioned, the traders coming wringing their hands and declaring that no animals could be trained without spears or without their necks being tied up day and night (the two cruel practices which Milroy had suppressed), but their education then commenced. One trader, rather than submit to these new-fangled notions, paid in full for his elephant on the nail, and said he would train it as he liked, and the fact that he did so and that this was the only elephant out of 104 to die did more than anything else to boom our new methods. The big females were kept the second year, but we lost only one out of 263 trained."

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The North Cachar venture showed that casualties during training could be reduced to negligible proportions and that enhanced profits were the result, the Government proportion on the two years being nearly 2 lakhs of rupees. In the following year operations were undertaken in Kulsi, Mr. N. L. Bor joining as Assistant to Milroy, the revenue being Rs.30,822. In 1925-6 Bor was placed in charge of the operations in the Goalpara District and hoped to train about a thousand elephants in two years with a mortality of about 1 per cent. "The most encouraging result of our efforts," wrote Milroy, "has been that the Burma and Ceylon Governments have been enquiring about our methods, and that the Government of Bihar and Orissa has sent a Veterinary Officer to be trained by Mr. Bor. It is to be hoped that the authorities elsewhere in the East, and in Africa, will quickly recognize that humanity in training elephants is handsomely rewarded financially, and is the only method that a civilized Government can countenance."

BURMA

Yield of Produce.—The principal source of yield in timber in the Province is still the Teak, although during the present century it has proved possible to place other species of timbers on the market, to which an impetus was given during the War.

The average annual outturn of produce during the past five quinquenniums and for 1924-5 is as follows :

Period.	Major Produce.				
	Timber.		Fuel. cub. ft.	Total. cub. ft.	
	Teak. cub. ft.	Others. cub. ft.			
1899-1900 to 1903-4 . . .	54,866,042	75,236,963	84,381,066	214,484,071	
1904-5 to 1908-9 . . .	59,368,756	84,525,793	82,368,550	226,263,099	
1909-10 to 1913-14 . . .	71,429,950	112,287,930	102,445,850	286,163,750	
1914-15 to 1918-19 . . .	86,289,550	92,096,350	194,050,600	372,436,500	
1919-20 to 1923-4 . . .	128,354,000	131,545,000	251,124,000	511,023,000	
Year 1924-5 . . .	21,378,000	21,446,000	60,217,000	103,041,000	

Period.	Minor Produce.						
	Bamboos.		Grazing. Value in Rs.	Sale of grass. Value in Rs.	Lac.		Other Produce. Value in Rs.
	No. in thous- ands.	Value in Rs.			Maunds	Value in Rs.	
1899-1900 to 1903-4	427,256	7,85,471	3,02,509	—	—	—	9,64,801
1904-5 to 1908-9	384,752	10,96,529	6,63,210	140	47,146	1,05,203	12,05,791
1909-10 to 1913-14	415,101	12,86,332	10,97,211	232	88,453	2,03,832	13,85,257
1914-15 to 1918-19	405,343	12,64,352	15,85,504	420	64,853	1,39,471	16,29,924
1919-20 to 1923-4	456,537	14,89,240	14,87,835	924	340,076	13,08,868	19,95,511
Year 1924-5	98,347	2,93,327	2,39,253	490	24,251	1,26,938	3,18,461

Financial Results.—The revenue of the Department has shown a fairly consistent increase during the past quarter of a century, the increase during the last quinquennium being abnormal and, the Chief Conservator considers, unlikely to be maintained. The average figures for the periods and for 1924-5 are as follows :

Period.	Revenue.	Expenditure.	Surplus.	Proportion of Surplus to Gross Revenue.
1899-1900 to 1903-4	3,67,48,020	1,39,91,281	2,27,56,739	61·9 %
1904-5 to 1908-9	4,69,58,165	1,83,13,519	2,86,44,646	61·0 %
1909-10 to 1913-14	5,17,43,611	2,00,71,064	3,16,72,547	61·2 %
1914-15 to 1918-19	5,66,76,793	2,56,82,437	3,09,94,356	54·6 %
1919-20 to 1923-4*	9,59,63,462	4,32,02,616	5,27,60,846	55·0 %
Year 1924-5	1,81,84,904	92,43,571	89,41,333	49 %

In the *Quinquennial Review* for 1919-20 to 1923-4 the Chief Conservator (Watson) has the following remarks, which to some extent were common to India as a whole : " The quinquennium opened with undue optimism in respect of the possibilities of expanding the trade both in teak and other species. As a result teak of inferior quality was extracted in excess of the demand and in many cases down to an unprofitable standard. The period of depression at the close saw the markets glutted with stocks of these poor-quality logs, much of which will have to be disposed of at a loss or even written off. As regards species other than teak the period opened with a very optimistic view of the possibilities of marketing hitherto unknown species and concomitant with this the possibilities of extraction on a larger scale. Disillusion followed. It was soon realized that marketing of new species would be a slow process involving beforehand much spadework in research and practical demonstration of their utility, and that extraction enterprise on a large scale implied a tonnage of marketable timber per acre greater than that existing in the average natural mixed forests in Burma. The close of the quinquennium saw the acceptance of these conditions combined with a steady effort at commencing technical research and a policy of roads to extend the radius of extraction in the interests of the petty trader who must form the backbone of all working of the cheaper timbers."

* Includes Federation of Shan States Revenue and charges for 1922-3 and 1923-4.

The total outturn of teak for the last quinquennium (to 1924) amounted to 2,476,849 tons, an increase of 751,000 tons or 44 per cent over the output of the preceding quinquennium. In addition to the undue optimism alluded to above, the other causes for the increase were the rapid extension of concentrated regeneration by *taungya*, and the extension of cultivation, both of which involved Clear Felling. Watson considers that this high output from the natural forests is unlikely to be touched again. As regards the outturn of timber other than teak 2,562,301 tons were extracted during the last quinquennium, an increase of 39 per cent over the figures for the preceding one. This increase reached its maximum in 1921-2 and subsequently decreased owing to trade depression. Only 3.5 per cent was extracted departmentally, 33 per cent came from the Reserves and 67 per cent from Unclassed Forests.

With a view to expanding the market timber was consigned to Messrs. Howard Brothers, London, and to Messrs. Martin & Co., Calcutta, as agents for sale. The Burma teak firms took exception to this departure on the part of the Department, representing that it would interfere with their business, and the shipment was discontinued at the end of the quinquennium.

Bamboos form one of the chief of the minor products of Burma, and it appears possible that paper pulp mills with the bamboo as their raw product will be erected in the country. That the trade in minor products such as cutch, for instance, is capable of a considerable expansion appears possible. The chief items at present, in addition to bamboos and cutch, are lac, canes, barks, *thitsi* and miscellaneous items. As indicating the relative importance of these articles the revenue realized in 1923-4 was as follows: bamboos, Rs.283,000; lac, Rs.414,000; cutch trees and cutch, Rs.1,56,000; canes, Rs.23,000; barks, Rs.30,000; *thitsi*, Rs.8,000, and miscellaneous, Rs.1,05,000. When research has made headway it will be possible to differentiate a little in that lakh of rupees of miscellaneous items. The revenue on lac and cutch represent the export duty collected by the Customs Department and credited to the Forest Department. As some of the produce comes from the Federated Shan States it has been settled that for five years from 1st October, 1923, thirteen-eightieths of the revenue from lac and 3 per cent from cutch exported from Burma shall be credited to the Federation. In connection with lac, an interesting departure was made. Mr. C. F. Bell was transferred in 1923 as Conservator of Forests, Central Circle,

from the Central Provinces. The latter is the chief centre of lac cultivation at present, and considerable study has been given to the subject. Bell suggested that research into the propagation of lac should be commenced in Burma, and during the cold weather of 1924-5 two Imperial Officers from Burma were deputed to the Central Provinces to study the methods in force there. The experimental work will be conducted in the neighbourhood of Maymyo. It would appear possible that cutch is worthy of investigation. The factory near Bareilly (*vide* p. 661 *infra*) appears to have passed the experimental stage, and should the demand for the material increase Burma should be able to take a leading part in its supply.

The grazing question, in its bearing on forest management, is of little importance at present. The revenue obtained in Burma in 1924-5 (*vide* tabular statement) was well over 2 lakhs. The value of rubber removed from the Unclassed Forests in 1923-4 amounted to Rs.30,000 only.

Generally speaking, in the past, elephant-catching operations were left to private parties. Kheddah operations by Government agency were commenced in 1902 by the Kheddah Department. Owing to serious irregularities in management, the main operations were stopped in 1908 and finally closed down in 1911-12, on the ground that the financial loss was greater than any benefits received. The capture of elephants was then left to private agency under licences issued by the Deputy Commissioners. Recent enquiries by the Chief Conservator into the position of affairs has disclosed the fact that matters have been conducted in a very haphazard fashion. European officials had little acquaintance with the methods adopted, the chief being known as the "Karen method." Koonkie elephants are not used in this method, the wild ones being man-handled from the moment of capture. Mr. Atkinson, a Divisional Forest Officer, had often witnessed this method and characterized it as inhuman and barbarous in the extreme, the mortality amongst new captures being high. The Chief Conservator considers it is probably as high as 50 per cent between capture and fully trained. The method in force was that the licensee paid a royalty of Rs.50 per elephant captured, other than sucking calves, and Government had a right of pre-emption up to one elephant in five of all captured at an average price of Rs.1,200. The rest were sold by the licensee, an average figure being about Rs.2,500. 1556 elephants were captured by the Kheddah Department

during the period 1902-11, mortality figures not being recorded. Between 1920-5 figures of captures were as follows : 1920-1, 828 ; 1921-2, 898 ; 1922-3, 752 ; 1923-4, 609 ; 1924-5, 176. Total, 3263 elephants.

A Committee was appointed to consider this matter. Capture by Government Agency is unlikely to be revived on the grounds that it will not pay. It is proposed to continue to allow capture by licensees, but to centralize and control operations under the Department. The assistance of Assam was invited, and it has been decided (1925) to make a trial of Milroy's new methods and to definitely settle on some more humane manner of capture and training.

ANDAMANS.—Considerable progress was made during the period with timber extraction operations from the forests in the Andamans. This work was alluded to in Volume II, page 513, when Ribbentrop's views on the subject were recorded. Various methods of rafting were experimented with and specially constructed timber boats were in use. The following figures show the amounts of produce extracted for the five quinquennial periods from 1899 to 1924 :

Timber, cubic feet : 2,272,520 ; 3,517,160 ; 3,428,812 ; 4,511,693 ; 4,780,448.

Fuel, cubic feet : 8,033,554 ; 4,992,827 ; 6,273,247 ; 4,369,333 ; 4,226,852.

Totals, *Timber* and *Fuel*, cubic feet : 10,306,074 ; 8,509,987 ; 9,702,059 ; 8,881,031 ; 9,007,300.

Bamboos : 3,236,484, value Rs.1,327 ; 4,415,770, value Rs.4,303 ; 4,370,242, value Rs.2,729 ; 4,551,221, value Rs.2,842 ; 2,545,298, value Rs.3,947.

Other minor produce : Rs.27,969 ; Rs.39,720 ; Rs.25,374 ; Rs.16,373 ; Rs.15,920.

The figures for the year 1924-5 are : *Timber*, 1,133,820 cubic feet. *Fuel*, 842,870 cubic feet. *Bamboos*, 570,716 ; value Rs.1,644. Other produce, value Rs.5,418.

The revenue in 1899-1900 was Rs.2,60,000 and surplus Rs.1,19,660. In 1922-3 the revenue was Rs.5,88,000 (it had reached Rs.11,84,000 in 1918-19) with a deficit of Rs.2,17,157.

Figures for 1924-5 respectively were, Rs.725,597, Rs.11,53,690 and Rs.4,28,093.

BIHAR AND ORISSA

Yield of Produce.—This is a new Province (1911-12), but already there are indications that the yield from the forests

will be very much greater than the past has shown. The most valuable areas are those of the old Singbhum Division which, it will be remembered, first came under notice in 1864 (*vide* II, pp. 391 and 395). To those of us who have worked in the Singbhum Forests in the past and are acquainted with the present day efficient management it is fascinating to recall the Report of sixty years ago, in which the Commissioner wrote: "In the Hill Tracts, called Sarunda, there must be several hundredsquare miles of forest, chiefly sâl, which is at the disposal of Government, and there are other forests in the Hill Tracts of Singbhum, also at the disposal of Government, but all so remote that no precautionary measures, even for their preservation, are yet called for," and the Deputy Commissioner wrote: "Government owned the forests in Sarunda, Kersikela and Porahat. The extent of the forests is unknown, but they may be put down as large; Sarunda alone is a very large tract of heavy forest." It reads like a story from the *Arabian Nights*!

The outturn of forest produce, both major and minor, since the formation of the Province are as follows:

Major Produce.

Period.	Timber. cub. ft.	Fuel. cub. ft.	Total.
1912-13	1,296,021	16,085,891	17,381,912
1913-14	1,544,377	16,007,858	17,552,235
1914-15 to 1918-19	8,323,886	85,547,046	93,870,932
1919-20 to 1923-4	10,792,000	86,239,000	97,031,000
Year 1924-5	2,211,000	9,093,000	11,304,000

Minor Produce.

Period.	Bamboos.		Grazing and fodder grass. Value in Rs.	Lac.		Other produce. Value in Rs.
	No.	Value in Rs.		Mds.	Value.	
1912-13	9,279,536	54,699	90,411	2,700	616	83,692
1913-14	9,793,354	55,774	90,050	7,556	804	86,793
1914-15 to 1918-19	46,252,874	2,58,122	3,61,206	8,118	2,351	5,72,247
1919-20 to 1923-4	45,470,909	3,67,341	5,08,200	29,941	39,503	4,70,238
Year 1924-5	7,994,849	84,231	1,25,930	3,499	8,246	66,930

Financial Results.—The financial results of the Province show a marked improvement since it was formed.

Period.	Revenue.	Expenditure.	Surplus.
1911-12 . .	4,07,213	3,00,916	1,06,297
1912-13 . .	4,38,958	3,75,894	63,064
1913-14 . .	4,91,735	3,55,648	1,36,087
Quinquennial average :			
1914-15 to 1918-19	6,58,995	4,03,092	2,55,903
1919-20 to 1923-4 .	8,87,884	7,11,754	1,76,130
1924-5 (actuals) .	10,70,268	7,90,397	2,79,871

Apart from timber, minor produce is likely to play an important part in the finances of the Department. The bamboo (*Dendrocalamus strictus*) exists over considerable tracts as an under story and the royalty received on this product amounts to about an average of Rs.50,000 at the present time (1925). The grass known in this part of India as *sabai*, and in the United Provinces as *bhabar* (*Ischæmum angustifolium*) is abundant in some of the forest areas. At the present time it is held on a five year lease by Messrs. Balmer Lawrie of Calcutta, the annual royalty realized being Rs.23,336. In December, 1894, when I joined the Singbhum Division, from which the bulk comes, the annual royalty was about Rs.1,500, the collecting and baling being of the most rudimentary description. Two years later it was sold for about Rs.20,000 or so for a three year lease. Messrs. Balmer Lawrie collect the grass through the villagers, paying so much per maund for the work. They have presses for baling throughout the forest. The grass is used for paper-making. In the Sonthal Pergannahs Division all the *sabai* grass is now used locally by the villagers.

Lac is an article which may be a fine revenue producer in the Province in the future, and, as will be shown, the Province is taking the question of its cultivation seriously. Lac is cultivated departmentally in some areas, the average revenue at present being about Rs.15,000. A programme for the formation of lac plantations has been drawn up to plant out some 760 acres during the next five years (from 1925) in different districts of the Province in order to provide brood lac to the ryots. It is proposed that there should be about 8 brood lac farms. The total cost is estimated at a lakh. The sanction of the Legislative Council has still to be obtained. A noteworthy departure has been taken by a body termed the Lac Association, a business association of traders in lac. The object is to devise improved methods of propagation,

cultivation and manufacture. To this end a Lac Institute Building has been erected at Ranchi under their auspices. This building was completed in July, 1924, and had not started functioning in March, 1925. The staff had, however, already commenced work. The Forest Department has given permission for experimental work to be carried out in the lac areas in the forests. The Institute Staff are also experimenting on a small scale to ascertain the best methods of growing trees for lac cultivation purposes. The possibilities before such research work are enormous and the Province is to be congratulated on having it conducted under their auspices.

As regards grazing, the Conservator states that grazing is permitted, on payment of fees, in all Reserves where sylviculturally permissible. No fencing is done in the young crops on areas worked under the Uniform System. As is commonly the case, the people will only graze their animals in the outer portions of the forest and will not go far in.

THE CENTRAL PROVINCES AND BERAR

Yield of Produce.—In no Province in India, perhaps, have the results of a more intensive management coupled with a closer supervision during the last few years been more marked than in the Central Provinces. Good harvests helped towards the improved receipts, but the major contributory cause was the acceleration in opening out communications combined with better supervision.

The outturn of major and minor produce for the past five quinquenniums and for 1924-5 is as follows :

Period.	Major Produce.		
	Timber. cub. ft.	Fuel. cub. ft.	Total. cub. ft.
1899-1900 to 1903-4	2,672,753	16,510,556	19,183,309
1904-5 to 1908-9	4,470,800	18,751,322	23,222,122
1909-10 to 1913-14	6,875,599	27,063,804	33,939,403
1914-15 to 1918-19	8,180,964	26,632,928	34,813,892
1919-20 to 1923-4	8,929,800	26,116,600	35,046,400
Year 1924-5	11,836,000	27,556,000	39,392,000

Period.	Minor Produce.						
	Bamboos.		Grazing. Value in Rs.	Fodder. Grass. Value in Rs.	Lac.		Other Products. Value in Rs.
	Number.	Value in Rs.			Maunds.	Value in Rs.	
1899-1900 to 1903-4	—	1,24,700	4,06,765	1,29,246	—	11,172	1,99,305
1904-5 to 1908-9	—	1,86,951	8,77,177	1,82,963	—	27,038	2,52,668
1909-10 to 1913-14	—	2,35,743	10,13,491	2,56,359	—	27,071	2,61,340
1914-15 to 1918-19	—	2,67,308	15,09,852	1,63,004	—	47,541	2,71,382
1919-20 to 1923-4	—	3,11,356	14,89,247	2,37,262	—	3,31,289	2,70,556
Year 1924-5	34,262,962	4,27,610	15,72,061	3,29,321	1,647 Leases	1,01,021 7,696	3,78,328

Financial Results.—The revenue of the Province has exhibited signs of a striking capacity to increase under a more liberal policy of grants for opening out communications and tapping inaccessible forests. This upward trend may be confidently expected to continue at an increasing ratio, provided funds are made available for necessary cultural operations over the large areas where past neglect has imperilled the prospects of future fine and valuable forests. The revenue in 1899-1900 was Rs.12,97,490, the expenditure Rs.12,75,820 and the surplus Rs.21,670 only. That there was a lack of real progress in the Province during a period of sixteen years is evidenced from the state of the revenue between 1904-5 and 1919-20. In the first eight of these years the gross revenue remained in the neighbourhood of the 20 lakhs, only once reaching just over 25 lakhs. For the remaining seven out of eight years it remained in the 30 lakh category, being just below 35 lakhs in 1918-19 and reached just under 45 lakhs in 1919-20. The gross revenue for 1922-3 was Rs.47,60,115, for 1923-4 Rs. 51,04,930, and for 1924-5 Rs.52,32,633.

The average figures for the past five quinquennial periods and for 1924-5 are as follows :

Period.	Revenue.	Expenditure.	Surplus.
1899-1900 to 1903-04 .	15,64,936	12,36,168	3,28,768
1904-05 to 1908-09 .	22,46,408	14,61,476	7,84,932
1909-10 to 1913-14 .	28,58,975	17,86,926	10,52,049
1914-15 to 1918-19 .	33,93,251	18,70,630	15,22,621
1919-20 to 1923-4 .	45,00,601	26,18,163	18,82,438
Year 1924-5 .	52,32,633	31,13,045	21,19,588

Commenting on the improvement shown in the figures of the last quinquennial period, the Chief Conservator writes (*Quin. Rev.*, 1919-20 to 1923-4) : " The average gross revenue, the expenditure and the surplus show an increase of 33, 40 and 24 per cent, respectively, the percentage of expenditure and of the surplus to gross revenue being 58 and 42 per cent against 55 and 45 per cent in the previous quinquennium. The improvements made in the pay of the staff of all classes account for the increase and decrease in the percentages of expenditure and surplus to gross revenue. The above results have more than fulfilled the hope expressed by Mr. B. B. Osmaston (the preceding Chief Conservator) in his last Review."

The question of the position of the minor products of the forests of the Province is of considerable interest and, in the case of grazing, not without its serious aspects. With reference to the supply of bamboos the average annual number exploited of late years has been in the neighbourhood of 30 million, the figure shown by Bengal, a curious anomaly.

The grazing question is one for which a solution has yet to be found. It is very much in the position it held thirty years ago and similar arguments are being used to those in force then, viz. that any changes introduced must be brought in cautiously and slowly, which, in this case, has meant the *statu quo ante*. I had the opportunity of discussing this question with Sir W. Standen, Chief Secretary, in Nagpur in March 1925, and also with the Chief Conservator. The forests of the Provinces are far too valuable and have too great a future before them to permit of any doubt that a satisfactory settlement of the difficulties will be achieved, once they are understood and fairly faced. The position appears to be the following: The policy of Government is to allow cheap grazing for the cultivating classes; the present multiplication of rates is bewildering; Berar cultivators are allowed free grazing according to the number of ploughs maintained; the Central Provinces cultivators graze cattle at the privileged rate, varying from 1 to 4 annas, cattle at the ordinary rate varying from 3 to 10 annas and other cattle pay what is known as the commercial rate from 8 annas to Rs.1. Corresponding rates for buffaloes run from 4 annas to Rs.2.8. An increase in rates has been advocated both by the Agricultural Department and the Forest Department but Government insist on any such increase being effected very gradually. The result is that little appears to have been done beyond putting on a rupee per annum on cow buffaloes in the sâl forests in the last two years. Many forests are said to be heavily overgrazed.

Working Plans of more recent years have a grazing settlement which lays down the villages which may graze, the number of cattle and locality; the general incidence being 3 to 5 acres per animal. Few forests are closed to buffaloes, and any attempt to cut down the number of these animals using the forests meets with opposition. It is urged that cow buffaloes are agricultural cattle and that, as their numbers are smaller than those of other cattle, the damage they do is really



EFFECT OF OVERFELLING, BAD FELLING, FIRES, ETC., IN
RYOTWARI TEAK FORESTS, MELGHAT, BERAR

R. T. Jenkin, photo.



YOUNG TEAK FOREST AFTER THINNING—ADJACENT TO RYOT-
WARI FOREST. NOTE GENERAL EFFECT OF FIRE PROTECTION
AND CULTURAL OPERATIONS. MELGHAT DIVISION, BERAR

R. T. Jenkin, photo.



REAFFORESTATION OF SEMINARY HILL, NAGPUR, CENTRAL PROVINCES

less—while in actual weight they are not much heavier than cows and bullocks. The fallacy of working by a grazing incidence in forests on hilly ground is obvious; the animals affect the bottoms and lower slopes of the hills on which the best forest growth is found and consequently the best parts of the forest bear the brunt and suffer most. Grazing in places is said to be so heavy that at the close of the rainy season no grass survives in the drier forests. Most of the grazing takes place in the rains.

In the sâl forest savannahs in Balaghat, Bilaspur and Mandla buffalo grazing, on account of adequate fodder being unobtainable elsewhere, is reasonable but the rates are still very low. The highest rate is Rs.2.8 per annum, when it is said it ought legitimately to be 8 annas per mensem at the least. Buffalo grazing in the drier forest connotes lopping, so does goat grazing, but both continue and the extension even of goat-grazing has been advocated quite recently, regardless of the damage that must follow. A welcome departure from the policy indicated in this connection is the removal of all goats from the Damoh Division on account of lac propagation on the *ghont* (*Zizyphus xylopyra*)—their favourite food and consequently the favourite tree for the *goalas* (herdsmen) to lop. Buffalo graziers lop *bija* (*Pterocarpus Marsupium*) habitually and, in some of the worst cases of an entire lack of fodder, *Stereospermum* and *Gardenia* spp. as well. Another disquieting feature is the large number of cattle entertained by forest villagers who bring in outside cattle to graze during the rains. The result is an ever-enlarging area under deterioration round many forest villages, and much opposition is being encountered in two Circles to the carrying out of Government's recent orders that large herds are not to be allowed in forest villages and that the grazing of cattle is to be so distributed that undue pressure is avoided. Commercial cattle are chiefly affected by the latter order as agriculturists must have their grazing near at hand.

The whole problem is also complicated by the grazing lists prepared by the Revenue Officials to distribute the cattle according to the various rates. The result is that many cattle are now grazing at ordinary privileged rates based on the number of ploughs used when they should be paying commercial rates. The number of ploughs can be multiplied to an alarming degree so that ordinary and privileged cattle are sent away to cattle camps for the rains, and even buffaloes

are admitted at ordinary privileged rates. All this entails loss of legitimate revenue. Perhaps the worst feature is the location of large herds in forest villages; these are often the property of the villagers themselves and orders have had to be issued recently emphasizing the necessity for forest villages being retained as centres for labour supply and cultivation of field crops and not of the cattle-breeding industry. In some cases 8 annas per annum only is charged for forest villagers' buffaloes and *malguzars*, who levy as much as Rs.3 per head, can graze their own cattle in Government Forest at 3 annas while renting out their grazing grounds to others. In a general note on forest work of the Provinces from the sylvicultural point of view the Sylviculturist writes: "The greatest evil with which the Department has to contend is the enormous number of cattle whose demands for grazing have to be met. This combined with the general low rainfall makes problems of regeneration difficult." Compare Ribbentrop writing on the same subject over a quarter of a century ago (II, p. 551).

The question is by no means confined to the Central Provinces. Many other Provinces are in much the same position. There appears to be no finality to the numbers of animals likely to demand grazing from the forests. Yet it is thoroughly recognized that if a forest is to be maintained in perpetuity there is a definite limit to the grazing it can afford. Every European Government with a Forest Estate has thoroughly grasped this natural law. It is curious that India, with the recognition of the value of and the necessity of the Forest Estate both economically and financially, should still be reluctant to face and settle one of the fundamental laws of nature—for it is at least obvious that excessive grazing and browsing and the growth and development of young plants are incompatible and cannot proceed at one and the same time.

In areas for which intensive Working Plans are in force the grazing question has been settled in conjunction with the District Officers before the Working Plans received sanction. But as yet only a fraction of the Reserves of the country are under intensive Working Plans.

One of the most important items of minor products is lac (*Tachardia lacca*). The cultivation of this insect has received considerable study in the Central Provinces during the present century, Mr. A. E. Lowrie, Deputy Conservator, having given

a great deal of attention to the matter. Formerly it was the dye obtained that was in demand. Substitutes replaced the dye and for a time the importance of this minor product dwindled. It was revived, however, when the resinous product acquired a market value. In the earlier years of the new demand the collection of the product was leased out annually to contractors in the Damoh Division. From 1915-16 to 1917-18 the Esociet Company was given the annual contract. In October, 1918, departmental working was introduced. During 1919-20 a sum of Rs.54,635 was expended on lac cultivation. The revenue resulting amounted to Rs.4,49,741, i.e. a net profit of Rs.3,95,106. In 1920-1 a revenue of Rs.4,47,868 was obtained, the expenditure being Rs.1,20,754 and the net profit Rs.3,27,114. Considerable fluctuations in price took place in the markets at this period. Maitland (Sylviculturist) writes (1925): "Fluctuations in price were so great as to make cultivation speculative but recently stabilization of prices due to steadier and increased demand now make regular production feasible. The industry represents practically a world's monopoly for India and no satisfactory substitute has been produced." On the subject of disposal, i.e. sale and the rates obtained, he says: "Usually by auction at a fixed rate per maund at a lac bazaar. Such bazaars are held in the Central Provinces at Pendra, Rajim, Dhamtari, Gondia, Damoh, Katni, Bankheri and Itarsi. As a rough guide the rates for *phunki* (i.e. lac from which the insect has swarmed, lac with the insect still in it is termed *Ari*) lac are $\frac{3}{4}$ (*Kusum* being 1) and $\frac{1}{2}$ (for *Palas*, etc.) the rates for Calcutta T.N. Shellac. The latter should be wired for three days before the day fixed for sale. Sales are best held in the afternoon as the T.N. rates usually issue at noon. Lac should be turned out of the bags and graded in heaps before the sale. After sale it should be weighed out in the presence of the purchaser or his agent in his own bags and delivery made at once." It is a commentary on the old idea of the work of the Forest Officer to find his modern counterpart having to keep a finger on the Stock Exchange market quotations before holding auctions hundreds of miles away up in the "jungly districts!" Methods of cultivation have changed. Under the old method in the Central Provinces the upper one-third to one-sixth of the host tree was left untouched when the crop was collected. The brood on swarming consequently found the lower branches

YIELD AND REVENUE FROM THE FORESTS 645

The average annual outturn of produce during the past five quinquenna and for 1924-5 is as follows :

Period.	Major Produce.			
	Teak. cub. ft.	Other Timber. cub. ft.	Fuel. cub. ft.	Total Timber and Fuel. cub. ft.
1899-1900 to 1903-4 .	236,258	2,803,725*	16,151,012	19,190,994
1904-5 to 1908-9 .	300,215	2,734,083	21,213,307	24,207,604
1909-10 to 1913-14 .	234,298	4,006,233	22,322,270	26,562,801
	<i>Timber including Teak</i>			
1914-15 to 1918-19 .	4,257,163		20,883,862	25,141,025
1919-20 to 1923-4 .	4,543,000		20,305,600	24,848,000
1924-5 . . .	4,954,000		17,428,000	22,382,000

Period.	Minor Produce.			
	Bamboos.		Grazing & Fodder Grass. Value in Rs.	Other Produce Value in Rs.
	Number.	Value in Rs.		
1899-1900 to 1903-4 .	33,939,591	—	5,50,738	6,07,038
1904-5 to 1908-9 .	36,749,897	—	6,96,952	7,88,366
1909-10 to 1913-14 .	40,300,306	2,43,687	6,83,767	9,25,019
1914-15 to 1918-19 .	—	3,11,131	7,70,751	10,71,096
1919-20 to 1923-4 .	—	3,49,372	9,02,828	9,86,776
1924-5 . . .	—	3,44,856	8,36,009	7,65,945

Financial Results.—Progress in Madras, and consequently the revenue, stagnated for a considerable period of years. In 1882 Brandis foretold that a rapidly increasing revenue could not be expected (*vide p. 21 ante*). In 1913 Beadon-Bryant, when Inspector-General, was asked to visit Madras with a view to advising on methods by which the administration could be improved with a view to bringing the balance-sheet more into line with those of other Provinces and more in consonance with the area of forests in the Presidency. Beadon-Bryant's Inspection Note is a most interesting document, and proves beyond cavil the price Madras was paying for the refusal of her Government, through nearly half a century, to introduce a forest settlement in the country. The average annual figures for the past five quinquenna and for the year 1924-5 are :

* Sandalwood is not shown separately in the tabular statement.—E.P.S.

Period.	Revenue.	Expenditure.	Surplus.
1899-1900 to 1903-1904	24,91,487	17,32,999	7,58,488
1904-1905 to 1908-1909	33,74,000	24,86,000	8,88,000
1909-10 to 1913-14 .	40,72,000	31,86,000	8,86,000
1914-15 to 1918-19 .	46,13,000	28,76,000	17,37,000
1919-20 to 1923-4 .	52,25,383	42,40,059	9,85,324
Year 1924-5 .	55,69,681	51,17,796	4,51,885

During the year 1923-4, 15,951·64 cubic feet of teak, rose-wood, laurel (*Terminalia tomentosa*), *Lagerstræmia lanceolata*, *Cedrela Toona*, *Mesua ferrea*, *Pterocarpus Marsupium* and *Calophyllum tomentosum* were sent to Messrs. Howard Brothers. Some of this was for the Wembley Exhibition. Trade was slack and a portion only had been sold at the end of the year. On the yield and outturn generally the Chief Conservator writes in the *Quinquennial Report* to 1923-4: "The figures have remained more or less constant for ten years; now that exploitation of the valuable timber forests is being taken in hand a considerable increase may be looked for in the quantity of timber extracted." It may be hoped that this is a correct forecast, and that the policy by which, to some extent, funds have been made available is a correct one. It is no secret, however, that some Forest Officers of experience have grave doubts on this head.

Sandalwood is treated as a minor product. In the 1923-4 *Review of Forest Administration* the Chief Conservator writes: "710 tons of sandalwood were sold for Rs.7,86,118 (at Satyamangalam, 402 tons; at Tirupattur, 259 tons, and at Vellore, 49 tons). The average price realized was Rs.1,108 per ton, against Rs.1,182 in the previous year. The quantity sold was very considerably larger than the average of past years, and it is improbable that extraction on such a large scale is justifiable as a permanent measure. I have, however, purposely risked exceeding the possibility for the time being in order to provide the funds which are urgently required at present for the development of the more valuable timber forests. When once these commence to yield a reasonable profit, from which further development can be financed, it may be necessary to curtail the exploitation of sandalwood." In view of the strictures which have been made in the past at any tendency to overcut this valuable commodity this is a curious argument coming from the Head of the Forest Administration.

The other point which deserves comment in this place, since it will affect the yield under certain categories, is the intro-

duction of and development of what is termed "Panchayat Management." The forests of the Presidency have recently been reclassified into : (a) Forests of Provincial importance as being either remunerative or protective. (b) Local or Ryots forests. The latter cover an area of 3794 square miles and are chiefly situated on the east side of the Presidency and are mainly scrub forests, as has been indicated in several previous chapters of this history. The fact, however, that these forests produce small material, grazing, etc., required by the local population does not minimize their very great importance to the well-being of the community. In fact, locally, they are of greater economic importance on the country-side than heavy timber forests, the produce of which goes to distant markets. The Chief Conservator states that four times as much has been spent on these scrub forests in the past than on the big timber forests, such as the evergreen forests in South Kanara, etc. That senior officers have been in charge of the scrub forests Divisions and that work was concentrated upon them because they gave more revenue in grazing, fuel, etc., which led to the neglect of the big timber forests. The proposals before Government contemplate, it is understood, the eventual transference to panchayat (i.e. village) management under the Revenue Authorities the entire area of 3794 square miles. Some 800 square miles have already been so transferred. With the previous chequered history of Forest Administration in the Province before one, it is difficult to see how hopes can be genuinely entertained that this great area of absolutely essential forest will be efficiently administered, or that the new departure is administratively sound. Can the Province afford to even take the risk? Throughout Europe it has been proved times without number that a communal forest is doomed unless it remains under the management of the Government Forest Officers. This matter is explained as follows by the Chief Conservator in the *Quinquennial Review* of the five years 1919-20 to 1923-4 : " An important feature of the quinquennium was the development of the forest panchayat system. With a view to examine the question of promoting this system for Class V Reserves Mr. G. D. Bles, I.C.S., was placed on special duty for six months in 1920, and as a result of his recommendations a special staff consisting of a Forest Panchayat Officer and six Panchayat Inspectors was appointed. The operations of the staff were confined to the districts of Kistna, Guntur, Cuddapah, Bellary,

Chittoor, Chingleput, South Arcot, North Arcot, Trichinopoly, Salem and Coimbatore. At the close of the period under review 858 square miles of forests in those districts had been placed under panchayat management (by 457 panchayats). There were also 38 panchayats administering an area of 124 square miles in districts not under the control of the special staff. The spread of the panchayat movement has already rendered possible the abolition of two ranges, one in the Bellary District and the other in the Cuddapah District, and of the Kistna Division (since the close of the quinquennium). As the further expansion of the system is beyond the capacity of the existing staff, proposals for increasing the staff and extending the sphere of its activities are now under the consideration of the Government." In the *Annual Report of Forest Administration for 1923-4* (p. 15), the Chief Conservator, writing on the subject of these 457 panchayats, says: "The Forest Panchayat Officer reports that in 137 cases the administration was good and in 169 fair. Several of the better panchayats were inspected by Conservators after the close of the year and their Reports were on the whole favourable. In some cases it was found that protection was better than it had been under departmental management, while several panchayats had successfully raised small plantations of trees and had effected improvements by providing water facilities in and removing rank growth from grazing grounds. Some of the most efficient panchayats were formed in the Guntur District; this is a marked contrast to the lawlessness which prevailed there only a few years ago. When it was borne in mind how short a time has elapsed since the panchayat staff was organized, and how many difficulties there are in the way of organizing the administration of forests on communal lines, I venture to think that the progress made augurs well for the future of the system. Towards the close of the year a conference of Panchayatdars was held at Saidapet presided over by the Honourable Sir Arthur Knapp, K.C.I.E.; it served to bring together those interested in the movement in various parts of the country and to disseminate sound ideas on the value of the minor forests to the rural community and the consequent necessity for protecting and improving them." To many this latter object has always been considered a primary duty of the Forest Officer and a Forest Department. The idea that its duties are merely connected with safeguarding forests of a protective character and exploiting and

maintaining big timber forests for commercial purposes appears somewhat retrograde. Nor is the Department fulfilling its real economic functions *vis-à-vis* the community as a whole. One of the predominant troubles in the past in Madras has been the grazing question. Hopes of an improvement appear to be founded on the success of the panchayat system. In the last *Quinquennial Report* the Chief Conservator writes (p. 24): "One-fifth of the total area of forests was closed to grazing during the year 1923-4, while about one-fourth of the total area was closed during 1918-19. The number of animals grazed slightly increased from 2,045,678 at the beginning of the period to 2,141,770 in the closing year, the increase being chiefly due to grazing concessions allowed in the closing year in the districts of Salem, Coimbatore, North Arcot, Bellary, Anantpur, Kurnool and Chittoor on account of unfavourable season. The number of animals allowed free grazing increased from 29,075 at the beginning to 92,299 at the end of the period. The average grazing incidence during the last year of the period worked out to 4.59 acres per animal. With the extension of the forest village and panchayat systems the villagers have begun to evince interest in the conservancy and improvement of the grazing grounds adjacent to villages."

Brandis contemplated the ultimate formation of forest villages (*vide* p. 19 *ante*). But under the difficult conditions preceding 1882 he had to use considerable diplomacy and can scarcely be said to have contemplated communal forests for the management of which the Department has no responsibility. It appears to be a return to the old Jungle Conservancy Department which Brandis was instrumental in abolishing. "If," said Brandis, "the Jungle Conservancy Forests were to be of real benefit they must be managed by Forest Officers under the same legal protection as was to apply to the Reserved Forests" (p. 21 *ante*). Ribbentrop, with the added experience of twenty years, wrote in 1900 (*For. Br. India*), in connection with the grazing question: "Quite apart from the forest question, it is clear that the present way of dealing with these areas is wasteful from a fodder point of view, and more especially leaves no reserve in case of scarcity or fodder famine. The formation of fodder and grass reserves to obviate those consequences was proposed some years ago. In my opinion, no better reserves of this kind can exist than Forest Reserves managed under Working Plans framed with the purpose desired in view."

Mr. F. A. Lodge, a former Conservator of proved experience in the Presidency, wrote as follows in 1923: "As the area under Working Plans increased and the old permit system died, and restrictions were placed on the number of cattle admitted to the forests, Government sought for some means of freeing the village supplies of fuel and pasture from the control of the Forest Department. The 'Village forest' seemed to offer a solution. Village forests were first formed in the early eighties; they were limited to one District, and no control was exercised over them. They rapidly disappeared and the subject lay dormant for a quarter of a century. About 1911 an area of poor forest was handed over to five villages on the west coast, to be worked for the benefit of the villages by a panchayat of the leading men. They were informed that if they failed to maintain the forest it would be resumed by Government. About a year later I inspected the forest and found it heavily overcut. The panchayat had prescribed a felling period of five to six months, divided into five sub-periods, each of which was allotted to one village! The condition of the forest at the end of the felling period can be imagined. In order to provide village forests all the State forests were reclassified. The least valuable class was—when I left—being taken away from forest control and handed over to village panchayats. In this way large areas, which in time might have been nursed back into healthy forest condition, have been doomed to denudation."

In France, where the reasons for maintaining State Forests are well understood, it has not been found possible to allow the village authority to manage the Communal Forests without the State Forest Officer. The latter draws up the Working Plan, does all the marking, and is responsible that the provisions of the plan in respect to grazing, proper felling and so forth are carried out. Even in France, with three centuries of experience of Forest Management behind her, it has not been found possible to relieve the Forest Department of its responsibility *vis-à-vis* the Communal Forests.

The number of elephants in charge of the Department at the beginning of 1923-4 was 113, valued at Rs.3,57,550. Nineteen elephants were captured, 10 were born in captivity, 15 died and 23 were sold for Rs.35,855, leaving a balance of 104 elephants at close of the year. The pit method of capture is usually employed and capturing operations were undertaken in 1923-24 in South Coimbatore (1), the Nilgiris (10), the Wynaad (3), and Nilambur (5) Divisions, total 19 as com-

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pared with 32 captured in 1922-3. Three died and 5 were sold, the remaining 11 being valued at Rs.14,850. The cost of the operations was Rs.6,239. Keddah operations in the Mysore Forests, the constant blasting in the Mount Stuart Road construction work and shortage of fodder are said to account for the small number caught.

Three hundred and sixty-six elephants have been captured since 1890-1, the number in 1924-5 being 26. The pits are dug in the forest, a layer of brushwood being placed at the bottom and a light bamboo framework over the top on which earth and leaves are scattered. A captured elephant on being taken from the pit is placed in a kraal 12 feet by 12 feet with a thatched roof. A mahout is appointed to train him, a process taking three months.

COORG.—The following figures show the outturn for the five quinquennial periods between 1899 and 1924 :

Timber, cubic feet : 1,362,845 ; 1,223,694 ; 1,795,156 ; 1,808,114 ; 1,175,441.

Sandalwood, cubic feet : 49,850 ; 52,200 ; 50,700 ; 56,250 ; 90,350.

Fuel, cubic feet : 543,420 ; 420,270 ; 579,875 ; 836,082 ; 721,377.

Bamboos : 866,875, value Rs.5,272 ; 730,400, value Rs.4,964 ; 1,211,675, value Rs.5,984 ; 1,178,000, value Rs.7,501 ; 1,606,525, value Rs.9,802.

Grazing and Fodder Grass : Rs.11,989 ; Rs.4,964 ; Rs.4,913 ; Rs.12,185 ; Rs.5,721.

Other produce : Rs.75,600 ; Rs.82,043 ; Rs.1,06,860 ; Rs.1,09,449 ; Rs.1,01,781.

The figures for the year 1924-5 are as follows :—

Timber : 128,959 cubic feet. *Sandalwood* : 20,500 cubic feet. *Fuel* : 151,950 cubic feet. *Bamboos* : 310,232, value Rs.2,263. *Grazing, etc.*, Rs.1,040. *Other produce* : Rs.21,149.

The revenue for 1899-1900 was Rs.1,62,410 and surplus Rs.88,190.

For the year 1922-3 the revenue amounted to Rs.9,42,653, with a surplus of Rs.3,56,646 ; and for 1924-25, revenue Rs.6,67,884, and surplus Rs.3,14,097.

THE BOMBAY PRESIDENCY AND SIND

Yield of Produce.—Progress in Bombay has been remarkably steady during the past quarter of a century. Though many troubles and difficulties in working the forests still exist, inherited from more troublesome days, the practice of forestry science on up-to-date methods is undoubtedly in force and is reflected both in the yield and revenue. The yield of major and minor produce for the last five quinquennia and for 1924-5 is as follows :

Period.	Major Produce.			
	Timber. cub. ft.	Fuel. cub. ft.	Total. cub. ft.	Sandalwood. Value Rs.
1899-1900 to 1903-4	19,779,370	203,262,464	223,041,834	88,282
1904-5 to 1908-9	24,548,615	189,611,787	214,160,402	1,45,333
1909-10 to 1913-14	30,964,457	222,185,529	253,149,986	1,62,764
1914-15 to 1918-19	32,237,349	242,635,957	274,873,306	2,30,909
1919-20 to 1923-4	29,763,000	229,395,000	259,158,000	3,32,436
1924-5	5,888,000	43,777,000	46,665,000	76,009

Period.	Minor Produce.			
	Bamboos.		Grass Grazing.	Other Minor Produce.
	Number.	Value Rs.	Value Rs.	Value Rs.
1899-1900 to 1903-4	24,453,746 No. 14,429 cartloads. 50,826 headloads.	3,05,509	29,76,539	7,55,292
1904-5 to 1908-9	57,251,201 No. 67,384 cartloads. 7,846 headloads.	6,85,392	56,81,101	18,02,081
1909-10 to 1913-14	68,943,224 No.	5,95,817	62,20,430	25,52,362
1914-15 to 1918-19	74,625,895 No.	7,54,929	60,12,248	21,97,983
1919-20 to 1923-4	Not available.	7,37,639	64,74,729	17,47,300
1924-5	" "	1,32,335	16,60,502	2,76,503

Financial Results.—The average annual financial results for the past five quinquennia and for 1924-5 are as follows :

Period.	Revenue. Lakhs.	Expendi- ture. Lakhs.	Surplus. Lakhs.	Per cent of surplus to gross revenue.
1899-1900 to 1903-4	23.63	17.47	6.16	26.1
1904-5 to 1908-9	34.85	19.92	14.93	42.8
1909-10 to 1913-14	41.90	22.85	19.05	45.5
1914-15 to 1918-19	59.05	30.48	28.57	48.4
1919-20 to 1923-4	71.58	43.52	28.06	39.2
Year 1924-5	73.77	41.34	32.43	44.6

The revenue increased over threefold during the quarter of a century and the surplus over fourfold. The Chief Conservator, W. E. Copleston (in the *Quin. Rev.*, 1925, p. 72), explains the increase in revenue in the last quinquennium as follows: "The increase in revenue is due to the revision of the Thana Working Plan, the intensive regeneration system introduced in Surat and Peint, the revision of the grazing fees, larger supplies of timber and fuel departmentally carried out, to rise in prices, to improvement in communications and other operations for development. The increase in expenditure is largely due to the revision of pay of all services, to the construction of roads and buildings, to increased departmental operations, to great rise in rates of labour and material, and to a larger amount of money spent on developing the forests. The decrease in the surplus is misleading. The decrease is due not only to an increase in the capital expenditure from revenue. This latter undoubtedly increases the value of the forest property and will result in greater returns in future. The slump in trade which immediately followed the short-lived post-war boom has clean swept out of existence many a concern, but the Forest Department in Bombay has shown a handsome surplus all through, which not all Provinces could show. With all this the management is more scientific than ever it was."

Up to 1921-2 all expenditure on development was met out of revenue (the Forest Budget), as was commonly the case in the Department elsewhere. Since that year large works or schemes of a capital nature are now being financed out of a Provincial Loan. The Forest Department borrowings out of that loan amounted to Rs.6,40,108 at the end of March, 1924. This is a most interesting development and is worth comparing with the pronouncements contained in a Circular issued by the Government of India in 1867 on the subject of capital expenditure (*vide* II, pp. 22-5). The commercial system of accounting introduced into some Provinces in connection with especially large schemes has not been brought into force in the Presidency.

As regards minor produce, sandalwood extraction is entirely departmental in Dhawar-Bijapur and Belgaum, the chief Divisions in which the tree grows; but there are also some sales from the Eastern, Southern and Northern Divisions in Kanara. The Chief Conservator ascribes the increase of revenue latterly from this product to the "extrac-

tion and sale of a greater quantity of dead and dying sandal trees " but does not mention the cause of the mortality.

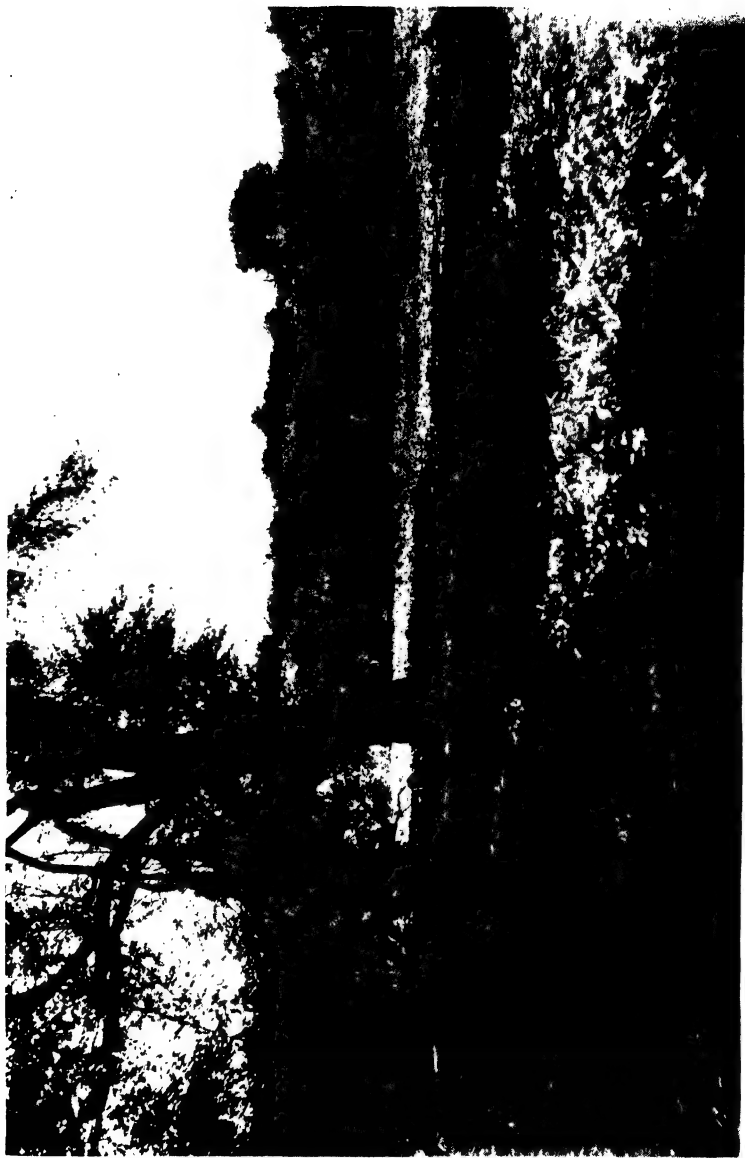
The credit of starting the departmental collection of myrobalans (*Terminalia Chebula* fruit) in the Presidency belongs to Colonel Peyton (p. 35 *ante*). They are still collected in this fashion in the Central Circle and the method was started in the Southern Circle, but was given up in preference for farming the right to collect. Another product which has come to the front of late is Rosha grass (*Andropogon*) used for distillation. This grass used to be collected by contractors in the different Divisions. In 1924, however, the right was given to a Company for five years on an annual payment of Rs.10,000. Lac in Bombay is still in the experimental stage, chiefly in Sind. A paper-pulp concern has recently (1924) signed a contract for working a paper-pulp mill from grass in Khandesh but has not yet started work (1925). The match industry is also receiving attention.

The difficult matter of the *gurcharan* and *varkas* lands, dealt with in a previous chapter on Bombay (pp. 40 and 43 *ante*), was again under consideration in the closing years of the period here considered. The compromise of 1889 had rendered this inevitable. The continued lopping for the *rab* cultivation had destroyed all species other than teak on many of the areas and the cry was for more forest. In addition to the *gurcharan* many pieces of forest were given out in the shape of private *malki* (called *varkas*). In these Government retains an 80 per cent interest in the sale of teak. The present procedure is for the Department to take over certain of the *gurcharan* areas, closing them for a period after Clear Felling, allocating an equal area of Reserved Forest for lopping purposes during the closure of the former.

In connection with the famines of which the Presidency has had more than its share of late years, Government has sanctioned, as an insurance against fodder scarcity, a storage scheme providing for a maximum reserve of 150 lakhs lbs. of pressed and baled grass at Dohad and Godhra for the Gujarat District, 150 lakhs lbs. at Palghar and 275 lakhs lbs. in the Nawapur area for supply to the Gujarat and Deccan Districts. The Chief Conservator writes : " The scheme has undoubtedly been of the utmost benefit and to render it more useful still, with a reduction in the chances of wastage and consequent loss to Government, a revision has been suggested to Government." Copleston continues, after dealing with the latter



YOUNG *BABUL* (*ACACIA ARABICA*) FOREST 3 YEARS OLD, BUT OPEN TO BROWSING BY CAMELS AND GOATS. COMPARE WITH PHOTO. ON BACK. HYDERABAD DIVISION, SIND.



TYPICAL YOUNG *BABUL* FOREST, 3 YEARS OLD. TWICE THE HEIGHT OF A MAN. THIS AREA HAS BEEN CLOSED

developments of the forests: "The Retrenchment Committee recommended the abolition of the post of Chief Conservator of Forests, the reconversion of the post of Conservator, Sind Circle, to that of a Deputy Conservator and various other less important measures. Government declared their decision in the Resolution No. 8352, dated 15th February, 1924, disagreeing, after careful consideration, with the majority of the recommendations made, but since 1921 reductions in permanent establishment, involving an annual expenditure of Rs.1,03,980 and in temporary establishment, involving an annual expenditure of Rs.1,06,072, have been carried out."

No Kheddah operations are carried out in the Presidency.

THE UNITED PROVINCES

Yield of Produce.—The position of affairs as regards the yield of produce in the United Provinces during the eventful years of the present century has been dealt with to a great extent in the exploitation chapter. But for the black chapter which the later history of Kumaun furnishes the Province would have had a fine record to show as a result of highly efficient management carried on over a long period of years. Up to a point the Province has proved that good road communications will certainly result in an increase of revenue. But beyond a certain point it would appear that increased efficiency in transport now requires the addition of mechanical appliances if the revenue is to feel the full benefit of intensive Working Plans, coupled with energetic and expert supervision. On this head Mr. H. G. Billson, the Chief Conservator, in reviewing the work of the Utilization Circle in his *Quinquennial Review of Forest Administration* (1919-20 to 1923-4) writes: "Experience has shown that all this money would have been better expended on schemes for mechanical exploitation and transport of the produce of our forests. Those constructed to date have been most remunerative. There is not the slightest doubt that a big mistake was made over the Sawmill and Turnery which has for the present shaken the confidence of the Legislative Council and rendered them suspicious of almost any scheme we now put up. Time alone and demonstration of result can cure this." The average annual yield of major and minor produce for the past five quinquennia and for 1924-5 are as follows:

Period.	Major Produce.		
	Timber. cub. ft.	Fuel. cub. ft.	Total.
1899-1900 to 1903-4 .	6,287,775	9,314,251	15,602,026
1904-5 to 1908-9 .	6,403,429	11,298,922	17,702,351
1909-10 to 1913-14 .	8,999,219	11,125,394	20,124,613
1914-15 to 1918-19 .	8,583,676	17,675,661	26,259,337
1919-20 to 1923-4 .	9,253,600	27,592,200	36,845,800
1924-5 .	11,334,000	27,672,000	39,006,000

Period.	Minor Produce.		Grazing & Fodder Grass. Value in Rs.	Other minor produce in Rs.	Resin. .
	Bamboos.	Value in Rs.			
	No.				
1899-1900 to 1903-4	15,202,820	1,31,883	1,58,288	1,29,948	—
1904-5 to 1908-9 .	20,317,307	1,58,577	1,91,314	2,53,868	9,187
1909-10 to 1913-14 .	15,822,062	1,83,151	2,38,516	3,94,224	21,392
1914-15 to 1918-19	20,265,248	2,16,952	3,52,964	11,01,530	56,968
1919-20 to 1923-4 .	19,191,479	1,74,104	4,73,608	17,18,338	53,766
1924-5 .	21,393,243	1,87,767	5,34,770	11,29,828	97,775

Financial Results.—The recent set-backs in forest administration which have been experienced cannot detract from the patent fact that the management has been very efficient during the present century. A gross revenue of under 16 lakhs in 1900-1 has been raised to nearly 69 lakhs in 1924-5. And in the boom year of 1920-1 it reached 87½ lakhs. A more striking illustration of a liberal financial policy towards the Department combined with the efficiency of a highly trained staff could not be found in India. And to their credit some of the Provinces have correctly read the lesson and have made perhaps greater strides in modern progress in some directions than has the United Province herself. The financial average annual results of the past five quinquennia and for 1924-25 are as follows :

Year or Period.	Revenue.	Expenditure.	Surplus.
1899-1900 to 1903-1904	18,00,296	10,01,999	7,98,297
1904-1905 to 1908-1909	23,83,712	13,03,973	10,79,739
1909-10 to 1913-14 .	29,90,443	14,67,239	15,23,202
1914-15 to 1918-19 .	50,42,067	31,78,172	18,63,895
1919-20 to 1923-4 .	79,06,922	59,89,038	19,17,884
Year 1924-5 .	68,86,799	36,32,055	32,54,744

Until 1923-4 the highest surplus made in the United Provinces was a little over 29 lakhs of rupees in 1917-18. The surplus for 1923-4 was nearly 31 lakhs—the highest on

record. To some extent it was due to economics, and, as Billson says, economics may be carried too far ! This surplus was, however, exceeded in the following year.

A larger head of animals grazed in the forests (1,113,367) during the quinquennium ending 1923-4 than in the previous one (911,486 animals). Channer considers that, as regards grazing privileges, the grazing burden is too heavy at the present day. Only 30 per cent of the forests are closed to grazing, the rest being practically open.

One of the most important minor products of the Province at the present time is resin. The growth of the resin industry has been remarkable and dates from the reservation of the Kumaun Forests. Channer gives an interesting account of this industry and the reservation of the forests in Kumaun.

" The Kumaun Circle of the United Provinces was constituted as a tentative measure for three years by Government Notification No. 411—XIV, dated the 2nd October, 1912, during the Lieutenant-Governorship of Sir John Hewett, and the step was largely due to his keen interest in forests and consequent appreciation of the fact that a mistake had been made in neglecting the far-stretching hill forests of British Kumaun and Garhwal at the time, some forty years earlier, when the policy of reserving what remained of the more accessible forests of the United Provinces was decided on. At that time only the outer fringe of the hill forests was reserved, the inner tract being thought almost inaccessible and of no importance. After a time, as the population increased, the gradual destruction of the forests began to attract the attention of the Civil Authorities and the areas not assessed to Land Revenue were made Protected Forests under the Indian Forest Act, certain rules of management under the Act being brought into force (*vide* p. 142 *ante*). The Deputy Commissioners were the controlling authorities, but for a good many years prior to 1912 there had been one Deputy Conservator in each of the two large districts of Almora (Kumaun) and Garhwal. These officers did a good deal in the way of protecting the more commercially valuable forests and started both the exploitation by water to the plains of the timber of the most valuable species, namely, the *chir* pine (*Pinus longifolia*) and the tapping of it for resin for supply to the Forest Department's Factory at Bhowali. They brought prominently to notice the great potential value of the forests and their rapid rate of destruction. The view that the

preservation and working of such large tracts required a settlement of rights and should be entrusted entirely to the Forest Department was eventually accepted completely by the then Commissioner of Kumaun, Mr. J. S. (now Sir John) Campbell, K.C.S.I. The reservation of the forests was decided on, subject to a proviso that the net revenue should be spent for the benefit of the Kumaun Division. The Forest Settlement began in 1911 under two members of the Indian Civil Service to each of whom a special Forest Officer was attached. These two officers in each district, in the course of four years, went over every piece of waste and forest land, made a temporary demarcation of proposed Reserves, settled the rights and concessions, and prepared notifications of reservation for publication. On the formation of the Circle in October, 1912, a Deputy Conservator of Forests was placed in charge to organize the working of the forests more or less on the lines found successful in the older Circles. The enormous areas of difficult country comprised in the Almora and Garhwal Districts were early split into two forest divisions each, known as North and South Garhwal, East and West Almora, while the smaller area in Naini Tal District was made into a fifth Division. By the end of the three years or so, in October, 1915, the Government was satisfied that a case had been made out for regular Forest Administration and the constitution of a regular Circle with an additional post of Conservator was sanctioned by the Government of India. This step was shortly followed by the absorption of the old Reserves of the Naini Tal Division (then in the Western Circle) which rightly belonged to Kumaun Circle and with these went the entire control of the resin industry with its factory at Bhowali near Naini Tal. The new Reserves had already started to make important contributions of crude resin to the factory.

A very important step had also been taken in October, 1913, to create a permanent market for Kumaun's immense stores of *chir* pine, namely, by setting up factories for antiseptic treatment of railway sleepers where the big rivers of Kumaun reach the plains. Though this undertaking met with many initial difficulties they were in a fair way to be overcome by the time the Kumaun Circle was made permanent and all prospects seem particularly bright. Unfortunately, this state of affairs did not last long. In 1916 the Government ordered a reconsideration of boundaries in the Kumaun Circle based on a campaign of protest against forest protection. The people of

Kumaun contributed enormously and most valuably to the Army and their dislike of forest control became increasingly difficult to contend with. This recruitment again reduced the labour supply almost to nothing. The War again brought disaster to the sleeper-treating business by stopping the import of antiseptics. The bright spot during the War was the enormous demand for *chir* timber, and the failure of the sleeper treating proved a blessing in disguise by enabling Kumaun to provide large quantities of ready-sawn sleepers to the Munitions Board at the time when they were most urgently required.

The close of the War had unfortunately seen a collapse of the *chir* market while political developments in Kumaun have brought a series of disasters. There has been such determined opposition to the Forest Settlement that it has just been more than half cancelled; the whole of the *chir* forests were burnt in 1921 and, apart from the consequent damage to the resin industry, there has been a determined effort by non-co-operators to prevent its continuance by interfering with the labour supply. Kumaun Circle is, therefore, now faced with an up-hill struggle to re-establish the resin industry and to find a new market for *chir* timber."

In the *Quinquennial Review* for the years ending 1923-4 Billson opens his Report with the following: "The quinquennium, owing mainly to the introduction of the reforms in 1920, has been singularly full of incidents. From almost the beginning of Council Sessions it became evident that the Kumaun Circle and the Utilization Circle were regarded with great disfavour. The first-named was relentlessly attacked owing to the hardships which it was alleged the application of intensive forest management was inflicting on the people. It afforded an admirable opportunity to agitators in sympathy with the non-cooperative movement to exploit these grievances, some real, mostly imaginary. The fact that the preservation of forests in the interests of posterity must necessarily entail definition of rights and concessions and restriction of destructive practices was ignored. Confronted with this organized and largely artificial outcry, Government felt compelled to appoint a Grievances Committee, who recommended drastic measures to which the term remedies was applied. They were remedies to the outcry, but disastrous to the future of the forests. Details will be found in the Annual Reports for the years concerned."

It may be suggested that, before irrevocable steps are taken to reduce the Kumaun Circle, thus condemning to inevitable destruction large tracts of valuable forest, and to fetter with restrictions the areas of forest left in the Circle, the Legislative Council should depute a nominee or nominees to make an inspection of the fine forests of a similar type in the Landes in France. Such a study will enable such nominees to see the wonderful development of the country-side resulting from the formation of these forests. They will find a contented people all immersed from highest to lowest in the ramifications of the resin and timber industry.

The expansion of the resin industry in the United Provinces between 1910 and 1920 is shown in the following statement :

	1910	1920
(1) Number of Channels .	260,000	2,135,000
(2) Approximate area of forest worked .	6,500	53,000
(3) Output of crude resin .	14,500	92,000 (maunds).
(4) " " " turpentine .	17,000	85,100 (gallons).
(5) " " " rosin .	9,000	48,500 (maunds).
(6) Gross revenue .	1,20,000	11,42,000 (Rs.).
(7) Nett " .	85,000	1,85,000 (Rs.).
(8) Capital value of distillery .	12,000	10,76,000 (Rs.).
(9) Value of stocks of produce and outstanding fills in hand at close of year .	7,100	12,38,000 (Rs.). |

The important experimental work carried out at Bhowali during 1910-13 solved the problem of obtaining a high-quality oil from *P. longifolia* resin, and enabled the industry to develop rapidly ; until this problem had been solved, the development was checked by the very limited demand for the produce. In 1918-19 a new large and up-to-date distillery was put up at Bareilly (Clutterbuckganj) which produces excellent grades of both rosin and turpentine."

The native methods of preparing cutch in Burma from the hardwood of the *khair* tree (*Acacia Catechu*) have been described in an earlier chapter (p. 67). The two extracts obtained from this wood are catechu or cutch and catechin or *katha*. Cutch contains a high percentage of tannic acid and has a high dye value. In Europe it is used for preserving

fishing nets, sails, etc., whilst in India it is eaten by the lower classes in conjunction with *Pan* leaf and betel-nut. Catechin is used by the better classes in India in the same way, being much more expensive than cutch. In the native method of manufacture the wood is chipped up and boiled down in earthenware pots. When the boiled material is of sufficient consistency it is poured on to sand and the catechu allowed to soak away, leaving the catechin. When catechu was desired the liquors were boiled down to a sticky consistency, then poured into leaves and allowed to harden, everything being retained. No departure had been made from the time-honoured methods of preparing these materials until recently, In 1919 a Company known as the Indian Wood Products Company, Ltd., was inaugurated by Messrs. Gillanders, Arbuthnot & Co., of Calcutta. The Company was formed to manufacture these extracts by machinery, a factory being erected at Izatnagar, near Bareilly. In the United Provinces the native manufacture is carried out by *khairis* in the forests. The methods adopted in the factory are the same in principle, machinery being substituted. Instead of allowing the catechu liquor to run to waste when making catechin, as is the native practice, the material is carefully collected and densified to such consistency that when it cools it hardens into blocks. The catechin retained is dried out for eating purposes and the catechu, which is much more pure, having had the catechin removed, is exported to Europe for tanning purposes; a certain proportion is prepared in Indian form and sold to the poorer classes. The manufacture is very interesting. Logs of *khair* (one of the hardest woods known) about 5 feet long are placed singly in a short inclined trough, the lower end impinging on a metal cylinder, set with numerous sharp projecting chisel blades half an inch or so in length, which rotates at high velocity. The blades cut the logs into chips, the log being reduced in a very brief time. The chips are put into large steam-heated autoclaves, where they are leached for a certain time, after which the liquors are taken off for filtering. The catechin is separated from the catechu and the separated liquors are then treated to reduce moisture contents and made into blocks of varying size. The liquor for the cutch is evaporated and the *katha* is dried out in drying-rooms heated by air. The fuel used is the spent chips from the autoclaves. The timber is obtained from the United Provinces Forest Department, with whom the Company have a profit-sharing agree-

ment in that the price of the trees varies according to the profit of the Company; the Provinces containing large areas of *khair*, which is mostly self-generating. The Company had many difficulties to encounter at first. These have been surmounted and a considerable amount of valuable experimental work has been carried out.

As regards elephant catching, the Chief Conservator states that the last operations carried out were in 1904-05, but no details of the licence issued are available. The Balrampur Estate did the catching with their own stud of elephants. The system in the United Provinces and Nepal is to track and locate the wild elephants and then drive them out with tame ones, chase them to a standstill and then noose and tie them up. No stockade is built, and if the elephants cannot be driven away from water, they keep refreshing themselves and are very hard to catch. It is somewhat dangerous work. Twenty-five elephants were caught in 1904-5. Previous recorded captures were: 1891-2, 49; 1896-7, 49; 1899-1900, 59. The Chief Conservator considers that there are probably not more than 50-60 wild elephants now in the Province.

THE PUNJAB

Yield of Produce.—The figures for the yield of major and minor produce for the past five quinquennia and for 1924-5 are given in the Table on p. 663.

Financial Results.—The average annual financial results for the past five quinquennia and for the year 1924-5 are given in the subjoined table:

Period.	Revenue.	Expenditure.	Surplus.
1899-1900 to 1903-1904	15,00,675	10,30,729	4,69,946
1904-1905 to 1908-1909	16,02,074	10,84,998	5,18,076
1909-10 to 1913-14	12,34,516	7,88,350	4,46,162
1914-15 to 1918-19	19,03,046	11,85,268	7,17,778
1919-20 to 1923-4	39,83,738	35,47,289	4,36,449
Year 1924-5	37,27,312	26,14,344	11,12,968

Owing to the paucity of Senior and Subordinate Staff, at the head of which was a single Conservator, progress in the Department in the Punjab was very slow. The revenue, with several rises and falls in the interval, was just over 1 lakh higher in 1914-15 (Rs.14,66,593) than in 1900-1 (Rs.13,50,842), although it had reached 18½ lakhs in 1904-5. The War, as in the case of the United Provinces, brought about a big demand for

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produce which the trade slump and other causes reduced. But the Government became awake to the possibilities and considerable augmentation of the staff has resulted in a much-improved financial position and more intensive management. The present position in this respect has been alluded to in Chapter XI, page 258 *ante*.

The possibilities of largely increasing the yield from the forests were considered in a Memorandum on Reorganisation of the Punjab Staff, written by Mayes (30th October, 1919) when Conservator of the Eastern Circle, Punjab. The following

Period.	Major Produce.		
	Timber. cub. ft. solid.	Fuel. cub. ft. solid.	Total. cub. ft. solid.
1899-1900 to 1903-4	17,289,440	174,959,136	192,248,576
1904-5 to 1908-9	26,865,503	126,506,017	153,371,520
1909-10 to 1913-14	26,373,404	98,163,862	124,537,266
1914-15 to 1918-19	39,819,859	139,135,633	178,955,492
1919-20 to 1923-4	31,246,000	138,829,000	170,075,000
1924-5	5,045,000	29,348,000	34,393,000

Period.	Minor Produce.						
	Bamboos.		Grazing and fodder grass. Value in Rs.	Resin.		Other minor produce.	Total Rs.
	No.	Value in Rs.		Maunds.	Value in Rs.		
1899-1900 to 1903-4	4,417,716	1,09,557	22,57,215	—	—	4,62,479	28,29,251
1904-5 to 1908-9	1,628,928 + 1,037 acres.	33,451	23,76,345	—	—	3,51,665	27,61,461
1909-10 to 1913-14	3,615,142	63,869	87,05,301	24,688	1,97,504	4,31,722	93,98,396
1914-15 to 1918-19	5,376,166	1,93,742	1,10,51,131	84,638	4,40,293	3,05,539	1,19,92,705
1919-20 to 1923-4	5,201,941 + 1,076 acres.	3,18,757	1,10,24,150	1,89,193	11,99,643	3,61,436	1,29,03,986
1924-5	850,663	45,910	22,22,264	46,041	2,07,680	71,587	25,47,441

s.—"Nirgals" or hill bamboos (*Arundinaria falcata*) are included under "other minor produce."

extract summarizes the position of the Province: "In the hills only the *chil* pine (*P. longifolia*) and the deodar are being comparatively intensively worked; but the output is capable of very large expansion under the system of concentrated regeneration fellings, which is the system being adopted by Mr. C. G. Trevor in the new Kulu Working Plan. The blue pine forests of the Province are not being worked to anywhere near their capacity; and the vast areas of silver fir and spruce, extending over many thousands of acres, are as yet practically untouched. Mr. Jerram's recent Working Plan for the *chil* pine forests of the Murree and Kahuta Tehsils of

the Rawalpindi District increased the output of timber in that tract from 104,000 cubic feet to 664,000 cubic feet per annum. Mr. Trevor's Working Plan for the Kulu Forests provides for an annual gross yield of 4,178,000 cubic feet of timber as compared with approximately 1,385,000 cubic feet under the old plan; an increase of practically 3,000,000 cubic feet, valued at, at least, Rs.22½ lakhs per annum. It is estimated that the Bashahr silver fir and spruce forests alone can yield at least 2,000,000 cubic feet of timber a year, valued at Rs.15 lakhs. . . . As regards minor products, the resin industry, which restarted on modern lines in 1915, with a modest revenue of Rs.60,000 in round figures, has realized a maximum annual revenue of 4½ lakhs; is budgeted to yield over Rs.9½ lakhs in 1920-1, and can be extended to yield Rs.18 lakhs a year in the course of the next four or five years. The question of the utilization of wood-waste by destructive distillation has been the subject of small experiments; and the prospects of putting Stockholm tar and allied products on the Indian market at profitable rates may be considered good. The Punjab, with its great hydro-electric power schemes, its dry climate and large supplies of suitable timber, offers ideal conditions for the match industry, as the silver fir and spruce timbers make good splints and also veneer for boxes comparable with the Swedish products. As India imports over Rs.2½ crores worth of matches annually, this field of industrial development alone is of sufficient magnitude to justify early enquiry and development. Further details on these topics will be available in Chapter VI of the Annual Report of the Department for the Forest year, 1918-19. Enough has been said here to give an idea of what the Punjab Forests are capable of, given adequate assistance in men and money." It may be mentioned that a match factory under Indian management is now (1925) working near Lahore. If the management and supervision can be improved there appears to be no reason why it should not pay.

"To sum up, the Punjab Forest Department has now finished its preliminary stage, namely, the provision for the people in perpetuity of those forest products they require in their agricultural pursuits. It is now entering its second stage of development, namely, that of becoming a big money-making concern, and increasing its production to the maximum by intensive working. Maximum output and maximum production are to-day the greatest needs, not only of the Punjab,

but of India and of the Empire as well. It is for the Punjab, working in close co-operation with its sister Province, the United Provinces on the east, and with Kashmir State and the North-West Frontier Province on the west, not only to make India self-supporting as regards coniferous timber, and to wipe out the £750,000 worth of pine timber annually imported into India, but to make the North-West Himalayan tract an exporter of such timbers and thus add *doubly* to the wealth of the country. Few industries can do without timber, and industrial expansion connotes a sufficient local supply. In the Punjab the cement industry may require huge supplies of timber for cask-staves; crating and tea-chest shooks will be other items of demand; while the cry from Karachi, Bombay and other large seaport or industrial towns will be for more and more timber. Should the Attock District petroleum oil industry develop as anticipated the demand for timber for this centre alone will be very great."

Five years later in the *Quinquennial Review* of progress to end of 1923-4, which it fell to Mayes to write as Chief Conservator, the general position is summarized as follows: "The Review for the Quinquennium, 1914-15 to 1918-19, closed on a note of optimism with the statement: 'everything points to a great development of the commercial side of the Department in the near future.' For the next two years it seemed as if this hope would be fully realized: timber shared in the post-war boom; revenue rose by leaps and bounds, and the Department launched out into the ambitious Talwara Saw Mill project. Then came the slump: the market for spruce and silver fir, from which so much had been hoped, vanished altogether and even blue pine could no longer be sold at a profit." The position was aggravated owing to the action of the North-Western Railway in giving a monopoly to a private firm for the entire supply of coniferous sleepers for a period of five years up to 1927. This resulted in the enforced liquidation of the Talwara concern at a heavy cost to Government. The export of deodar and blue pine was reduced in conformity with the demands of the market, and the extraction of silver fir and spruce was stopped. The Chief Conservator states, however, that in spite of the drawbacks to advance, the Utilization Circle has done much useful work.

As regards grazing in the Province matters can scarcely be said to be entirely satisfactory. Mountain forests all over the world are far more subject to damage by grazing and browsing

than is the case in the plains, and large flocks of sheep and goats are capable of committing irredeemable harm. This is too well known in the twentieth century to need insistence upon. In dealing with the question in Kangra and Kulu the Chief Conservator (1925) writes: "Kangra Forests, owing to heavy fires, browsing, grazing, lopping and misuse in the past, are very poor in quality and yield very little revenue. They are liable to very heavy browsing by goats and sheep belonging to the *Gaddis*, and the Department is involved in a continued struggle to prevent indefinite multiplication of these flocks and the consequent destruction of the forests (*vide* II, p. 550). Government is alive to the dangers of the position and is upholding the Department in its efforts to save the forests for the use of future generations. One method that has been adopted is to levy a tax throughout the district on sheep and goats. This is objected to strongly by the people who have to pay it, but is still in force, and it is hoped that it will not be abolished. The adjoining district of Hoshiarpur presents a specific instance of unrestricted burning, grazing, browsing, lopping, etc., in the so-called *chos* (II, p. 552). There are indications at present, by references to the Legislative Council and elsewhere, that responsible representatives of the people are beginning to be alive not only to the fact that unrestricted grazing and burning have done enormous damage, but that there should be proper management in order to preserve the areas in future."

The most important of the minor products of the Province is resin. The development of the resin industry was started by Mr. (now Sir) G. S. Hart in the Kangra Division in 1898. Mr. Hart's Assistant in those days was Mr. A. J. Gibson. After the first experiments had proved that distillation was feasible and the product was saleable, the development of the industry is said to be almost entirely due to Mr. Gibson. The first experimental still was erected at Nurpur in Kangra and the new industry made some small progress. Mr. Glover, Utilization Conservator, wrote a Memorandum (1925) upon which the following data are based:

During the year 1904-5 the Conservator of Forests submitted a Report to Government on the effect of the tapping operations of *chir* pine in the Kangra Forests, recommending that tapping be restricted to trees soon to be felled. The Nurpur Distillery was closed from the 1st of April, 1905, as the demand for small quantities of crude resin was good and

it was thought it could be sold to better advantage than could the extracted products. In the year 1908 Gibson was placed on special duty in America and France to study the most up-to-date methods of resin distillation. A resin still was purchased and erected at Shahdara, four miles from Lahore. Its cost was Rs.13,000, it being capable of distilling 8000 maunds of crude resin in a year. Experiments in tapping by the French and American methods were carried out, the former being chosen. Blue pine was also experimented with but was not considered to be a paying proposition at the time. After proving that resin tapping and distillation was a paying commercial proposition, it was intended at this time to make over the business to private individuals.

In 1913-14 a new plant was purchased of French design known as the Ropars No. 2 Resin Distillery Plant, at a cost of Rs.29,000 and capable of dealing with 40,000 maunds of crude resin annually, the then estimated maximum annual output of resin of the Punjab Forests. A heavy flood in the Ravi in 1914 caused considerable damage to the factory and it was decided to erect an entirely new factory at Jallo Railway Station, some nine miles east of Lahore. The new Ropars Still was installed and soon commenced to produce a high yield of turpentine oil with a great economy in fuel consumption.

The following figures show the output and number of channels or blazes between the years 1915-16 and 1923-4 :

Year.	No. of Blazes of Channels.	Quantity of crude resin (impurified distilled) Maunds.
1915-16	—	19,500
1916-17	500,000	22,000
1917-18	—	32,000*
1918-19	713,000	28,800†
1919-20	795,874	35,600
1920-1	883,611	36,500
1921-2	1,063,400	38,180
1922-3	—	77,265
1923-4	—	63,396

The price of the products varied considerably during the period.

* 10,000 maunds received from the U.P.

† 2,600 maunds received from the U.P.

In February, 1922, a co-partnership scheme of working was introduced owing to the desire of Government to associate private enterprise with the development of forest industries. Crude resin is delivered by Government at the factory at cost price. The Jallo concern is owned partly by Government and partly by a co-partner who introduces all fresh block capital and all working capital. Government receives 50 per cent of the net profits of the concern as royalty for the crude resin supplied, and the co-partner is paid 10 per cent of the profits for his commercial assistance and advice, the remaining 40 per cent being divided in direct proportion to the amounts of capital owned by Government and the co-partner. A supplementary Ropars' Distillation Still was purchased in 1922, shortly afterwards followed by an up-to-date Vacuum Distillation Plant capable of dealing with 250,000 maunds of crude resin per annum. The supply from Punjab Government Forest Divisions is roughly 60,000 maunds of crude resin a year, and considerable amounts of crude resin are purchased from other sources. The Jallo Concern has an arrangement with the Resin Factory of the United Provinces whereby Indian Sales Areas for the two factories are defined. Glover says that the standard of products is so high and the costs of production are sufficiently low to enable the Jallo Factory to obtain over 80 per cent of the import trade which was formerly confined to American products. Whilst the factory was still directly run by Government successful attempts had been made to place the resin and turpentine on foreign markets; there was, however, considerable difficulty in producing grades of resin and turpentine equal to those produced in America, but the Jallo products were sufficiently good to compete with American products in the open market. With the coming of the Vacuum Still it became possible to produce an excellent grade of resin equal to the best American W.W. resin, while the yield of turpentine quality 1 as compared with lower grades proportionately increased. In 1922 the Jallo Concern first sold resin and turpentine in Europe and on the African and Java and China markets at a small loss. As, however, Jallo products became better known the foreign demand increased and there is now no difficulty whatever in disposing of the whole outturn of resin of the factory. In spite of the fact that prices are said to have fallen about 40 per cent below war-time prices and that the Indian Railways import a turpentine substitute which affects the

Indian sales of this product, the Utilization Conservator states that the factory shows satisfactory financial results, said to be primarily due to the high grades of resin and turpentine which compare favourably with anything produced in America, and, secondly, to the business enterprise shown by the Jallo Concern which possesses the freedom from the departmental rules and over-meticulous financial control prevailing previous to 1922.

Resin oil, cartgreen, lamp-black and cobblers' pitch have been manufactured by the Jallo Concern, the first two in commercial quantities. Under the agreement with the co-partner minor products will be developed by him at his own cost.

CHAPTER XXII

AERIAL FOREST SURVEYS IN BURMA

A NOTABLE departure was made in Burma by undertaking the first aerial survey of a forest area ever made in India or, it is believed, the East. The use of the aeroplane in forest work was not unknown. In 1917, during the War, the author had occasion to visit Northern Russia. From Archangel he went up the Northern Dwina River several hundred miles to the foot-hills of the Urals. Nearly the whole distance lies through virgin forests of pine, spruce and birch. Mr. J. L. Bell, now Deputy Conservator of Forests in the Bombay Presidency, accompanied the 1918-19 Expedition to Archangel as an Air Force Officer. On his return to Edinburgh later on he gave the author several aerial photographs taken in the neighbourhood of Archangel. From these it at once became apparent how easy it would be to distinguish and select the most densely stocked areas of pine and spruce. The country is quite flat. In Canada the aeroplane has been employed on fire protection work and the Laurentide Company in Canada have successfully made use of aerial photography in the work of stock-mapping and surveying their forests. In fact it was the assistance and information given by Mr. Ellswood, formerly of this Company, to Mr. Watson whilst on furlough in England, which materially helped in carrying out similar work in Burma,

The forests over which the first aero-photo survey was carried out consisted of the Reserved Forests of the Irrawaddy Delta Division, extending over 1000 square miles. Topographically, except for a low ridge in the Myaungmya District rising to 120 feet, the area is essentially deltaic, being formed by alluvial deposits of the Irrawaddy; the plain is intersected by large and small creeks of the ordinary type met with in such regions. Of the seven forest types including "blanks" the three first are: (1) Pure or almost pure forest of *kanazo* (*Heritiera minor*) covering large areas and is the most valuable; (2) mangrove forest containing various species of *Rhizo-*

phoraceæ, usually confined to mud-banks along creeks ; (3) scrub jungle designated as *byaik*, of three types : (a) characterized by *Phoenix paludosa*, (b) by *Cynometra ramiflora*, (c) by absence of tree growth and presence of tall grasses and creepers. Mr. A. W. Moodie had made a Working Plan for these forests in which a full description is given.

Until recently the only map available was Fitzroy's reconnaissance map (4 miles to 1 inch) dated 1864. In 1918-19 a survey, which proved inaccurate and very expensive, was undertaken for 360 square miles. In 1921 Moodie commenced another survey by cutting linear survey lines at 1 mile intervals from north to south and east to west. The forest growth was also noted upon. This work was commenced before the aerial survey was proposed. The difficulties of carrying out such a survey or describing the forests in areas of deltaic nature are well known to anyone acquainted with them. He will appreciate the following : " Wide waterways with a rapid current ebbing and flowing with the tide ; mud-banks in which at every step the surveyor sinks to the knees or even further ; at high tide large tracts under water too deep to walk in ; small creeks only navigable at high tide in small boats ; and then, on the so-called land, even at low tide, a mass of aerial roots which makes walking slow and painful, and a dense tangled undergrowth through which every step has to be cut ; all this tends to make ground survey on an accurate scale slow and expensive." It is estimated that an accurate ground survey on a scale of 4 inches to 1 mile would have cost fully Rs.500 per square mile and would have taken three to four years. The description of the aerial survey actually undertaken is recorded in *Aero-Photo Survey and Mapping of the Irrawaddy Delta*, Burma. For. Bull., II (1925). This was compiled by the officers concerned in the work, Mr. R. C. Kemp, Major C. G. Lewis, R.E., Messrs. C.W. Scott, D.F.C., and C. R. Robbins, M.C., D.F.C., the latter two of the Forest Department. Blanford, Conservator, Working Plans Circle, writes an introduction. Reference should be made to this interesting brochure for a full account of the operations. A brief summary is only possible here.

The origin of the idea of undertaking an aerial survey is attributed to Mr. E. F. A. Hay, I.F.S., when in charge of the area. The idea does not appear to have received much consideration until Mr. H. W. A. Watson visited the forests in 1920, when Conservator of the Delta Circle. Watson was

greatly impressed with Hay's suggestion and pointed out that the conditions were ideal for aerial work, the country being absolutely flat, salient points easily picked up, whilst the *kanazo* stocking, which is abrupt and easily distinguishable in appearance and colouration from other growth, could be laid down without the cumbrous ground stock-mapping. The survey could also be put through in a few weeks instead of years. Both the Government and Colonel Ryder, Surveyor-General, were lukewarm. The expert opinion in 1921 with regard to aerial survey work in India seemed to prove that there was a difficulty in flying straight enough to obtain a regular series of strips covering a piece of country. The following year Mr. Kemp, the Chief Inspector of Aircraft in India, visited Burma. Watson discussed the matter with him and a conference was held in August, Mr. Smales, Chief Conservator, Colonel Ryder, Colonel Coldstream, Superintendent Eastern Circle, Survey of India, Mr. Kemp and Watson being present. The proposal was accepted and Mr. Kemp was asked to prepare detailed estimates for the work of 1000 square miles. The estimate was submitted and backed by the Surveyor-General, who promised co-operation and undertook: (1) The fixing of the necessary points, (2) the fair drawing of the sheets for publication. These services would not be charged for to the Burma Government as they would be useful for the ordinary 1-inch topographical survey which was an Imperial charge. The arrangements from this point came under Colonel Gunter, in charge of the Burma Circle, Survey of India, and this officer is credited with having finally obtained the assent of the Finance Committee in 1923 to the project being carried out.

Mr. Kemp's engagement with the Government of India having come to an end, he contracted with the Burma Government to undertake the work, the terms being the payment of Rs.2,75,000 for the first 1000 square miles and Rs.28,000 for a further 350 square miles if required to be undertaken later. The work to be carried out was briefly: The production of vertical and oblique photographs suitable and necessary for the compilation of a 4-inch = 1-mile scale map of the area. For the full detailed conditions reference should be made to Major Lewis' Note in the Bulletin. He also details the ground control undertaken by his party in December, 1923, and January, 1924.

A base for the aeroplanes was formed in Rangoon at Monkey

Point, some 90 miles by air line from the centre of the area to be surveyed. A moveable emergency and advance base was formed by a launch with a motor-boat and *sampans* (native boats). The type of seaplane used was a D.H. 9 Puma engine service type aeroplane converted to a seaplane by the fitting of floats designed by Mr. Kemp. Flying Officer Mr. J. Durward was lent on leave by the A.O.C., Royal Air Force (India), for employment as photographer, and Major C. K. Cochran-Patrick, D.S.O., M.C., late R.A.F., acted as pilot.

Photography was commenced in February, 1924, and completed early in April of the same year. Owing to the delays in settlement of the contract the start was not made as early as contemplated. January and February would, it is said, have been the best months, weather and visibility both being better.

The important part of the work which fell to the Forest Department to carry out was the examination of the forest with a view to settling how the different types of forest growth could be determined from the photographs. Fortunately in Messrs. Scott and Robbins the Department in Burma possessed two young officers who had made their names in the Royal Air Force during the War. They were deputed for short periods to examine the photographs and compare them with the actual types of forest on the ground. Both officers made trial flights over the area and visited parts of the forest. Their Reports are included in the Bulletin. As soon as the prints were available the preparation of rectified mosaics and the compilation of the maps were undertaken by Major Lewis' Party (No. 18) at Maymyo. As the actual scale of the photographs proved to be about 3.4 inches = 1 mile, it was agreed to alter the final scale to 3 inches = 1 mile since it would be easier to work up the rectified mosaics, from which the final map would be prepared. From the Reports of Scott and Robbins it appeared that eight to ten different types of forest could be distinguished on the photographs, and that it was possible to distinguish between fully stocked *kanazo* forest and the same forest which had been heavily worked. They were also of opinion that they could determine at least two quality classes of this type of forest from the photographs.

Blanford summarises the Reports of the officers as given in the Bulletin, from the Forest Department's point of view, as follows: "(1) Cost. The cost including ground work and mapping has worked out to about Rs.293.7 per square mile.

A ground survey on the same scale would have cost in the neighbourhood of Rs.500 per square mile, without giving an indication of the types of forest growth. (2) Rapidity. The actual survey was completed in five months and the whole period taken from the commencement of the fixing of the ground control to the completion of maps and stock maps should not greatly exceed one year. Ground survey would have taken three to four years. (3) Accuracy. This is far in excess of anything that could have been obtained by ground survey in this type of country except at a further increase in cost and time. (4) Details available. The areas and distribution of the different types of forests are not only obtainable at no increase of cost but with an accuracy that it would have taken years and a considerable expenditure to have equalled."

At the same time Blanford points out that both the country and type of forest were exceptionally easy and quite unlike the usual character of forest country throughout India and Burma where hills would predominate and where, moreover, the prevalence of a mixed deciduous forest might not prove easy to determine accurately. Scott made one flight over the Pegu Yoma. The season of the year was unfavourable as the deciduous forests were leafless and "looked very bare and featureless." Robbins says that 8000-10,000 feet is probably the best height from which to take photographs, taking all considerations into account including the cost, and remarks that "comparison of photographs with the ground from the air is a great help to their interpretation."

THE AERIAL SURVEY OF THE SOUTH TENASSERIM DIVISION

The second survey projected was a far more ambitious undertaking. It was recognized that the success of the Delta Survey was no criterion that such work would be possible in the case of the more ordinary type of forest country. Owing to the delayed start in 1923-4 it was not possible to carry out, as intended, a series of experiments over different types of forest on the hills, Scott's single flight over the Pegu Yomas being the only one attempted, owing to the lateness of the season. Proposals were, however, accepted by the Local Government to carry out a second season's work in 1924-5. This second survey related to over 14,000 square miles of unexplored forests in the South Tenasserim Division which were

urgently in need of examination owing to the possibility of commencing exploitation work within them. The whole of this area had recently been topographically surveyed by the Survey of India and 1-inch maps were available. In the air operations in Tenasserim, therefore, the stock-mapping of the forest was the primary and only object, whereas in the Irrawaddy Delta the topographical mapping of an unsurveyed area was the chief object, the stock-mapping being achieved simultaneously.

The contract was again made with Mr. Kemp. The detailed Report of this survey is in the press. Whilst in Rangoon, in February, 1925, I was given to understand that, as had been anticipated, photography was not yielding sufficiently detailed results. These forests are situated in hilly country with deep valleys, the nature of the growth in the latter not being brought out sufficiently strongly to be recognisable. Some 250 miles, I believe, had been photographed and then Mr. Scott, who was in charge, decided to devote the extra flying time which would be available under the contract (613 square miles were contracted for by photography) to aerial stock-mapping. The whole of this was undertaken by Mr. Robbins, Scott checking at times. By flying at a fairly low elevation considerable success was achieved in this manner.

In a letter received from the Conservator, Working Plans Circle, accompanied by a photo mosaic, he gives details of the types of forest ascertained from the photographs which are briefly summarized below :

The types of forest found in this region are : (1) Giant evergreen characterized by the presence of *Swintonia floribunda* with masses of *wathabut* bamboo (*Neohauseana Helfer*), canes and evergreen shrubs occupying steep slopes and small feeders. (2) Sub-evergreen, this is not constant and varies from a type resembling giant evergreen with smaller trees to a moist deciduous forest type with fewer bamboos. (3) Moist deciduous characterized by *Waba* bamboo (*Oxytenanthera nigrociliata*). The species found are *Xylia dolabriformis*, *Careya arborea*, *Dillenia* sp. and *Homalium tomentosum*. A common feature is open grassy blanks. (4) Dry deciduous forest occurs on a few ridges—*Dipterocarpus obtusifolius* of poor quality with an undergrowth of grass and wild toddy palm is characteristic of the type. (5) Tidal forest characterized by *Heritiera*, *Carapa*, *Rhizophora* *Bruginera*. (6) Areas of *taungya* cuttings.

Scott and Robbins spent some time before the commencement of the actual flying operations in examining various portions of the area from the ground with a view to describing the different types of forest. Some useful exploration work was undertaken and a number of types described and determined. This preliminary work is dealt with in Burma Forest Bulletin No. 14 (1925).

The results of the aerial survey are summarized as follows :

A stock map of some 15,178 square miles of forests, in difficult mountainous country, showing the distribution of thirteen different types of forest, has been obtained in one season at a cost of Rs.5.5 per square mile. It is estimated that it would have taken twenty years and cost at least Rs.15 per square mile to have examined the same area from the ground with sufficient thoroughness to have produced a stock-map on the same lines. A comparison of the reconnaissance map with the stock-map actually prepared on the ground during the past season in the Heinze and Kaleinaung Reserves by the Working Plans party under Mr. H. C. Smith show that they agree in essentials, and the differences in detail are so unimportant as to be negligible. It is not contended that the aerial stock-mapping method will supplant the ground one for Working Plans. The broad lines of the maps produced by the former method are eminently suited for preliminary surveys, or for reservation proposals, but have not the accuracy of detail for a scientific plan of management. They also provide immediate data as to the extent of shifting cultivation being carried out. A similar survey of the Chittagong Hill Tracts might be a possibility !

It will be admitted that this new departure, whilst being a direct outcome of possibilities, and the extraordinary advance in aerial science, which the Great War brought about, reflects the greatest credit on the Department in Burma. Its officers were quick to realize the value to which the new development might be turned in providing them, not only with surveys, but stock maps which in the ordinary course of work on the ground would have taken many years to prepare.

CHAPTER XXIII

A FEW REFLECTIONS AND AN ACKNOWLEDGMENT

IN looking back through the pages of this history of the Forests of India there are several reflections which would appear to be of sufficient interest to call for a few remarks. It has been said on more than one occasion that the British race have been more active in destroying forests than any other nation—a charge easily made but difficult to prove. Moreover, one which requires considerably more enquiry than has usually been accorded to it. It may be admitted that the British race has been responsible for very heavy fellings in the primeval forests of the world throughout the last hundred years or more. But these fellings (not always carried out by the British) have for the most part—in the Old World at any rate—been made to supply some definite requirement, the construction of ships, buildings, bridges, railways, and so forth; in other words, to provide for the needs of a developing civilised nation. The old ignorant destruction of earlier centuries in Europe, or in the New World in the past century, has not usually been practised by the British. To supply the markets species which had acquired a value were sought for and exploited without reference to the continued maintenance of the forests, as, e.g. mahogany, teak, the soft woods, and so forth. Accessible forests of these species were speedily cleared of the valuable species or cut out. In so far as this represents forest destruction the British have destroyed forests during the past century or so, or have been a consenting party to such devastation. In India the examples of the fine Malabar and Tenasserim Teak forests which were cut out early in the past century, and the accessible deodar areas in the middle of the century, furnish cases in point.

A study of the whole of the available history of the Indian Forests will, however, at once exonerate the British from the charge of intentional mismanagement and neglect. The evidence, when carefully sifted, appears to show that the value

of certain timber species of trees and other products had long been known in the country prior to the arrival of the British. That in some instances the Indian rulers farmed or worked the forests for these species themselves—often ignorantly or wastefully, as, e.g. the Teak forests under the Burman kings ; but, on occasions, with knowledge, as in the case of Tippoo Sahib in Mysore and the astute old Nilambur Raja of Conolly's day. In the north the Gurkhas were well aware of the value of the sâl forests and may be said to have taken full advantage of our abysmal ignorance at the time of all pertaining to forestry matters. For the rest, forest property was regarded from very much the same viewpoint by the people as had been the case in England in the times of the Saxon and Norman kings—with, in India, the addition of the habits of, firstly, annually firing the forests in the dry season, undertaken by the agricultural population throughout the country ; and, secondly, the widespread practice of shifting cultivation in the forest areas by the nomadic forest tribes.

It is possible to trace, in these volumes, three periods in the consideration and treatment accorded to the State forest property in India.

Previous to the time at which we commenced to rule over the major part of the country the demand for Indian timbers was small, both within and without the country. The Arab trade in teak had existed for centuries, but the Arab fleet consisted of comparatively small vessels, as is the case at the present day, and has a definite limit to the amount of timber annually required, a practical point in economics which is becoming evident to the Divisional Officer at Nilambur. Within the country the population for the most part used small-sized timbers, only Burma proving an exception to the rule. A study of Indian history would seem to indicate that in earlier times large timbers were also used for constructional purposes, but the records extant are scanty ; and the climate and white ants quickly caused the disappearance of such erections, if they did exist, after their sacking by a fresh invasion of conquerors. The advent of the British resulted in a considerable demand for large-sized timbers, practically confined to teak at the outset, either for export, for Admiralty purposes, or for use in the dockyards in India and by the Public Works for the construction of the numerous Government buildings, cantonments, etc., which a settled administration of the country rendered necessary. Two other timbers were

called upon to furnish these supplies, the sâl and the deodar. But even in the unrestricted fellings practised one factor stands out in strong relief. The records clearly indicate that officials in the country and at home were not unmindful of the necessity of replacing the forest on areas cut over. The wish, even the intention, was there. It was merely the knowledge of how to carry out the desire that was absent. The very extensive correspondence which passed between the three Governments of Bengal, Madras and Bombay and the East India Company Directors affords incontrovertible evidence of this contention.

The second period, when a statesmanlike administration of the forests began to make its appearance, opened with Lord Dalhousie's proclamation in connection with the Pegu Forests in 1855, which has been termed the Charter of the Indian Forests. This was shortly followed by the appointment of Brandis as Superintendent of these forests. The first introduction of forest conservancy dawned in India. Up to this time both Government and people, with the exception of some small attempts on the part of the former to replace the cut forests by plantings and sowings, had been mere users of the forests. The first attempts at confining exploitation to the possibility of the forests being worked and the beginnings of protection were now introduced. Progress under the first of these heads was limited by a very small and untrained staff, when the magnitude of the undertaking is taken into account ; under the second, by the fact that it ran counter to the habits of the people, practised and enjoyed unchecked through past centuries. The work of this second period involved the selection of the forests to be reserved or protected for State purposes, under one designation or another, to definitely restricting shifting cultivation, to the introduction of an unknown and incomprehensible (to the people) feature of the new administration in the form of fire protection, and, lastly, as difficult, the attempted gradual restriction or settlement of the unchecked grazing of the ever-increasing herds of the population on the country-side, which threatened the accessible forests with extinction and hindered the introduction of Working Plans. The gradual increase in the numbers of a trained staff enabled these problems to be dealt with on an increasing scale during the later years of the last century.

The third period may be roughly dated from 1905-6. Two important factors which, so far as the historian can at present offer an opinion, appear to have had a far-reaching influence

on modern forest progress in India, had their origin in these years.

The first was the transfer of the education of the Indian forest probationer to the University, the second the inauguration of the Research Institute. These two factors appear to be mutually interdependent. Few would argue against the contention that the officers who were trained on the Continent of Europe and at Cooper's Hill were better qualified for their work than the untrained men, their predecessors, although each in their turn carried out invaluable work. But scientific conservancy and the introduction of the Working Plan only became possible and made a real advance when the first trained men began to grasp the helm, having under them as assistants a trained staff.

Similarly, a study of the position to which scientific forest conservancy has attained would seem to indicate that the advent of the young officer holding a University degree has proved an advantage of no mean importance to forestry in India. Elsewhere in this volume I have commented upon this factor; the further I went on my tour in India in 1925 the more convincing it appeared to become. A score of years hence proved facts will be in existence from which obvious conclusions will be derivable; but it would appear to be already apparent that no central isolated school of forestry could have produced the type of Forest Officer who is now reaching administrative rank and who has so largely helped in the striking advance in the practice of scientific forestry in all its aspects which the last decade and a half has witnessed. If he has been fortunate it has been due to the administrative progress which led to his advent on the scene coinciding with the birth of the Forest Research Institute.

As a result of my study of the present position of Forestry in India I have definitely made the statement that in some respects, and in some Provinces, India can show as good and efficient examples of forest management as are to be found in those European countries famed for their scientific forest conservancy. I believe this to be true. But in a country so extensive, where its Forest Department is responsible for areas of a size no Forest Department has ever before attempted to scientifically conserve, the Forest Officer is only at the commencement of a gigantic task. His position in 1925 differs from that of his confrère of 1905 in that the officer of 1925 has found his feet. If I may be permitted the poetic licence (the

thought occurred to me in India), with a smile on the lips and serious eyes he is cajoling that retiring lady, Dame Nature, to yield up some of those silvicultural and other secrets, the assimilation of which is imperative if the Forest Estate of fifty years hence is to be a worthy monument to his work. Only the highest trained staff willing to carry on the example of unflinching hard work set by the men of the past will enable this possibility to become a certainty.

An eminent scientist and naturalist, of great age, recently wrote: "First among the proverbs of Solomon, which the men of Hezekiah, King of Judah, copied out, stands that which says, 'It is the glory of God to conceal a thing: but the honour of kings is to search out a matter.' The proverb speaks as though there were sometimes a direct intention of Nature to puzzle and mystify the student, to put him on his mettle in dealing with the intricacy of the problems. There is the playfulness of a riddle propounded, the seriousness of an education designed."

AN ACKNOWLEDGMENT

Owing to considerations of space it has not proved possible in the previous pages to fully acknowledge the great assistance accorded to me by Forest Officers during my visit to India in 1925 and tour round the Provinces. Both at the headquarters and out in the forest divisions I was met and shown round by the officers in charge and the various details of present management and of the progress achieved were explained to me. My acknowledgments are due to the following:—

Headquarters, Government of India.—Up at Simla at the close of my tour I had some interesting conversations with Mr. J. W. Bhore, C.I.E., C.B.E., I.C.S., Secretary Department of Education, Health and Lands, bearing upon points of policy then under consideration. With the assistance of Sir Peter Clutterbuck, C.I.E., C.B.E., Inspector-General of Forests, which has been ungrudging throughout, I was able to place myself *au fait* with the existing position and to obtain information upon matters which had cropped up or had appeared to demand enlightenment during my tour round the country. To the Superintendent of his Office I am also indebted for lucid extracts from important files,

Bengal.—Messrs. E. O. Shebbeare, Conservator, who accompanied me on the tour in Bengal ; E. A. C. Modder, D.F.O., Buxa Division ; W. E. Hodge, Kurseong Division ; R. A. M. Macalpine, Working Plans Officer ; F. J. A. Hart, Darjeeling Division ; G. W. Houlding, Forest Engineer, and Mr. J. Walker, Superintendent Conservator's Office.

Assam.—Messrs. W. Meiklejohn, D.F.O., Goalpara, and H. P. Smith, Goalpara Division.

Burma.—Mr. U. Pu, Minister for Agriculture, Excise and Forests ; Messrs. H. W. A. Watson, Chief Conservator ; H. R. Blanford, O.B.E., Conservator of Working Plans, who toured with me ; W. A. Robertson, Utilization Conservator ; A. B. Nixon, Personal Assistant to Chief Conservator ; G. C. Cheyne, D.C. Forests ; F. W. Carroll, D.F.O., Tharrawaddy Division ; J. W. R. Sutherland, Lecturer Forestry School, Rangoon University ; Messrs. T. Marlow and B. O. Johannes, Exploitation Works.

Bihar and Orissa.—Messrs. A. R. Dicks, Conservator, and J. W. Nicholson, Research Officer.

Central Provinces.—Sir Montagu Butler, K.C.S.I., Governor of the Province, who kindly accorded me interviews and gave me valued assistance ; Sir J. Standen, Chief Secretary, with whom I discussed points of administration ; Sir H. A. Farrington, Bart., Chief Conservator, who accompanied me on tour ; Messrs. H. S. George, Personal Assistant ; K. F. R. Dickens, D.F.O., South Chanda Division and Lakhpat Rai, attached to this Division.

Madras.—Messrs. H. Tireman, C.I.E., Chief Conservator ; A. F. Minchin, D.F.O., Nilambur Division (now Conservator) ; C. R. F. Williams, Director, Madras Forest School, Coimbatore ; J. M. Sweet, Sylviculturist ; H. R. M. Law, D.F.O., Palghat Division ; R. S. Browne, D.F.O., North Coimbatore Division ; C. S. Marten, Chief Forest Engineer, and Major W. F. Chipp, D.S.O., M.C., Forest Engineer.

Bombay.—Messrs. A. G. Edie, Chief Conservator, whose camp I joined in the Presidency ; H. L. Newman, Conservator ; A. C. Hiley, D.F.O., North Kanara Division ; H. P. W. Davis, Working Plans Officer, North Kanara ; E. A. Garland, D.F.O., East Thana Division ; R. J. Smith, West Kanara Division ; Mr. S. N. Kesarcodi, Personal Assistant to Chief Conservator.

United Provinces.—Sir William Marris, K.C.S.I., Governor of the Province, who accorded me an interview during which points in administration were discussed ; Messrs. F. F. R.

Channer, Off. Chief Conservator ; J. Whitehead, Conservator ; E. A. Smythies, D.F.O., Haldwani Division ; W. A. Bailey, D.F.O., Dehra Dun Division ; M. P. Bhola, D.F.O., Gorakhpur Division ; M. J. McDonald, D.F.O., Afforestation Division.

Punjab.—Messrs. W. Mayes, Chief Conservator ; H. M. Glover, Utilization Conservator ; W. E. Flewett, D.F.O., Northern Plantation Division ; Khan Sahib Allah Bakhsh, Changa Manga ; Mr. Sundar Singh, attached Simla Division ; Sardar Bahadur Singh, D.F.O., Southern Plantation Division.

Research Institute.—Messrs. A. Rodger, O.B.E., President, who showed me over the Institute buildings and explained the lay-out of the new Institute ; S. H. Howard, Sylviculturist ; R. N. Parker, Forest Botanist ; Dr. C. F. C. Beeson, Forest Zoologist ; Messrs. J. C. M. Gardnar, Systematist ; Captain H. Trotter, M.C., Off. Forest Economist ; Messrs. W. Raitt, F.C.S., Paper Pulp Section ; S. Fitzgerald, Seasoning Section ; L. N. Seaman, A.M.E.I.C., Timber Testing Section ; Captain J. H. Warr, Wood Preservation Section ; Mr. W. Nagle, Wood Workshops ; Mr. M. Gopal Ran, Assistant in Chemical Branch.

With few exceptions the above-mentioned officers were kind enough to write me special memoranda dealing with questions which I had had the opportunity of discussing *in situ* with them either in the forests or, more rarely, in the office. These memoranda have proved of very great interest and value, written, as they mostly were, by the officers actually engaged upon the works in question, often difficult problems in silviculture, exploitation and so forth. It has unfortunately proved impossible to reproduce these memoranda *in extenso* in this volume, though many merited such treatment. In so far as has been possible I have summarized them.

My thanks are especially due to the Inspector-General, all Chief Conservators, and to the Conservator, Bengal, for numerous memoranda, notes and statistics ; and for the same reason to Messrs. Canning, Blanford, W. A. Robertson, Smythies, Milroy, Minchin, Nicholson and Flewett.

In addition, the following officers, retired, or whose circles and divisions I was unable to visit, sent me interesting communications :—

Bengal.—Mr. R. C. Milward, late Conservator of Forests.

Assam.—Messrs. F. Trafford, Conservator, whom I did not meet ; C. G. Rowbotham, D.F.O., Cachar Division (now Off. Conservator of Province) ; A. J. W. Milroy, D.F.O., Kamrup Division ; W. R. Martin, D.F.O., Sadiya Division ; B. Sen

Gupta, D.F.O., Sylhet Division ; R. N. De, Loharghat, Kamrup Division.

Burma.—Messrs. C. W. Scott, D.F.C., and C. R. Robbins, M.C., D.F.C. on Aerial Surveys, sent through Mr. Blanford ; Mr. H. S. Single, on Rangoon University Forestry Course.

Bihar and Orissa.—Mr. A. J. Gibson, Conservator.

Central Provinces.—Messrs. H. S. George, acting Personal Assistant to Chief Conservator, owing to injuries received from a tiger whilst in charge of the South Chanda Division ; V. K. Maitland, Sylviculturist.

Madras.—Messrs. S. Cox, C.I.E., late Conservator ; F. A. Lodge, late Conservator of Forests ; A. Wimbush, Conservator, V Circle ; F. R. Madan, D.F.O., South Mangalore ; J. K. Pearce, Logging Engineer, and K. T. Matthew, attached to Engineering Branch.

Bombay.—Mr. G. S. Butterworth, Acting Conservator, Northern Circle.

United Provinces.—Mr. H. G. Billson, C.I.E., Chief Conservator ; F. Canning, Conservator ; J. E. C. Turner, Central Almora Division.

Government of India.—Mr. R. G. Marriott, D.C. Forests, attached to the Railway Board.

Research Institute.—Messrs. W. F. Perrée, C.I.E., President up to January, 1925 ; R. S. Pearson, C.I.E., Forest Economist up to March, 1925.

GLOSSARY

Asan=*Terminalia tomentosa*
 Asseina=*Terminalia tomentosa*

Babul=*Acacia arabica*
 Balli=Pole
 Basha=Cane or bamboo-built hut or small house
 Bigha= $\frac{1}{8}$ acre ; $\frac{1}{4}$ acre in Bengal
 Bullies=Poles

Chawki=Toll station
 Chil, Chir=*Pinus longifolia*

Devarakadu=Sacred groves
 Dhya cultivation=Shifting cultivation

Ghât=Mountain ranges (crests) in Bombay and Madras
 Girdling=Ringling (cutting a ring round the stem into the sap wood)

Harra=Fruit of *Terminalia Chebula*

In=*Dipterocarpus tuberculatus*

Jarul=*Lagerstræmia Flos-Reginæ*
 Jemadar=Non-commissioned officer ; overseer
 Jhum, Jhuming=Shifting cultivation

Kachas=Newly thrown up banks of soil by Indus River

Kankar=Lime nodules

Karris=Poles

Karubars (Coorg)=cultivators

Katha=Cutch

Khair=*Acacia Catechu*

Khal=Channel (usually tidal)

Khan Tahsil=Revenue collected direct by Government

Kikar=*Acacia arabica*

Koonkies=Tame female elephants employed for catching wild ones

Kumaki=*vide*, Râb

Kumri=shifting cultivation
 Kusum=*Schleichera trijuga*
 Kutcha=Jerry-built, poor
 Kutcha road=Mud road, unmetalled
 Kyakatwa=*Bambusa arundinacea*

Lakh, Lac=100,000

Maldahs (Sind)=Owner of property
 Malguzars=Officer in charge of a local revenue charge
 Maund=80 lbs.
 Mehal or Mahal=Quarter of a town or village ; a district
 Merishdars=The holder of a heritage ; proprietor of land
 Muzadar=Officer in charge of a local revenue charge

Nazul land (U.P.)=Land lapsed to the State

Paisaris=Lands outside Reserves not included in revenue-paying areas ; free lands (Coorg)
 Pakka=thorough, well built
 Pakka road=Metalled road
 Palas=*Butea frondosa*
 Parganna=Civil division of a district
 Patwari=Village accountant ; village registrar
 Peon=Orderly or messenger
 Pipal=*Ficus religiosa*
 Pyinkado=*Xylia dolabriformis*

Ráb=Cultivation by use of loppings of trees which are spread over area and burnt
 Ragi=*Eleusine Coracana*, a millet
 Ryot=Peasant

Sál=*Shorea robusta*
 Sanad=Title deed ; deed
 Seer=2 lbs.
 Shindad=*vide* Tahal
 Shisham }
 Sissoo } = *Dalbergia Sissoo*
 Sissu }
 Simul, Semul=*Bombax malabaricum*

Tahal=Loppings of green trees used as manure for cultivation
 Tahsil or Tehsil=A local revenue charge
 Tahsildar=Officer in charge of a local revenue charge
 Taluk=Tenure

Taluka=Revenue subdivision of a district

Taungya=shifting cultivation

Taungya, regeneration by=raising tree crops in conjunction with
field crops

Thingan=*Hopea odorata*

Thitsi=*Melanorrhæa usitata* varnish

Urudves=Village forests

Varkas=Hill lands under cultivation

Ya=area cleared for shifting cultivation

Zemindar=Landowner of revenue farmer

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